

February 6, 1937

## "Nothing to Say"

Up to press time for AUTOMOTIVE INDUSTRIES there was no break in the cautious preliminary negotiations between General Motors and Union interests. Adjourning the first conference at 6.30 p. m. Thursday last, both sides refused to issue statements. From Governor Murphy it was learned that both sides were favorable to continuing the conferences and would reconvene.

When asked whether the meetings in question were to be regarded as preliminary to a discussion of the principal issues, Governor Murphy said "I have nothing to say."

Meanwhile General Motors refrained from petitioning Judge Gadola for a writ of attachment to enforce his injunction.

## Strikers Defy Eviction Order

*Flint City Officials Organize Police Reserves As GM "Sit-Down" Situation Becomes More Tense*

By Harold E. Gronseth

With sit-down strikers determined to hold the captured General Motors plants in defiance of court order to evacuate and with Governor Murphy apparently unwilling to remove the men, Flint city authorities are arming vigilante groups in order to cope with the situation.

"Unless John L. Lewis wants a repetition of the Herrin, Ill., massacres he had better call off his union men," said Police Chief James V. Wills. "The good citizens of Flint are getting pretty nearly out of hand. We are organizing fast and will have between 500 and 1000 men ready for any emergency."

After a short-lived non-violence truce, City Manager John M. Barringer joined Wills Thursday morning in resuming the issuance of guns and equipment to civilian police reserves. "When officials and authorities of the state whose duty it is to protect life and property fail to do so, organization of the good citizens is all that we can do," Wills declared.

At 3 P. M. Wednesday, when the injunction issued by Judge Gadola became effective, several thousand strike sympathizers began a demonstration in front of the Fisher plant No. 1 while sit-down strikers continued to occupy the plants.

Attorneys of GM announced they would procure a writ of attachment for sit-down strikers in the two Fisher body plants. The writ would call upon the sheriff to evict the strikers.

Conferences between Lewis, Knudsen and Governor Murphy were resumed Thursday morning in an effort to find a basis for peace. No statement of progress has been issued. Among the conferees are also Donaldson Brown and John Thomas Smith of GM, Homer Martin of the UAW, Lee Pressman, counsel, and James F. Dewey, Federal conciliator.

Evacuation of the two Fisher Body plants in Flint, which have been occupied by sitdown strikers since Dec. 30, was ordered Tuesday by Circuit Judge Paul V. Gadola, after hearing argu-

ments by attorneys for both sides on the petition of General Motors Corp. for an injunction. Further picketing of the plants also was banned.

Genesee County sheriff, Thomas W. Wolcott, was instructed to read the court's order on the premises of the plaintiff, such reading to constitute "sufficient notice to all concerned to evacuate."

"I will take the men out of the plant. There is no question about that," said the sheriff.

In his decision, Judge Gadola stated: "The proceedings involve a single question. It is of no importance, except for the great public interest involved in the strike. The question is solely the right of the defendants to occupy the premises and to picket the premises."

"It is proper that this question should be brought before the court. If the defendants are entitled to possession, they should get assistance of the court in protecting that possession. The defendants have not seen fit to do that but instead the plaintiff has tried to get aid of the court in defending its right of possession. Therefore, the court must decide the right to possession."

"The courts cannot set up tribunals to pass on labor disputes. The Legislature must do that. The English system provides for means for settling these disputes. The Danish system does the same thing. Some such system should be set up in America and this will probably be done soon."

"The courts can only enforce the  
(Turn to page 172, please)

## Jan. Total About 400,000

*Month's Production Tops '36 Figure Despite GM Shutdown*

Although impeded by strikes, motor vehicle production last month topped the January, 1936 output by a good margin. Had General Motors been permitted to operate its plants without union interference, an all-time January record would have been set by the industry, with production again well above the half-million mark as it was in the preceding month when a new December high was attained at 519,132 units.

Final January figure, which will not be available until late this month, will show that the industry did considerably better than indicated by any estimates made so far.

The total for the United States and Canada should closely approach 400,000 cars and trucks, comparing with 377,306 units built in January last year. This is in the face of a 60 per cent drop in GM production from what originally had been scheduled. At least 130,000 more units would have been added to the January figure with normal operations. It is quite unlikely that other companies would have slack-

(Turn to page 173, please)

## "Slow Down" Strike At Spicer Plant

At the Spicer Mfg. Corp. plant about 250 members of the Mechanics Educational Society started a "slow down" strike which affected production slightly at the plant. United Automobile Workers in same plant objected to the curtailment. Both unions are negotiating for renewal of agreements. Company offered five cents an hour increase in wages.

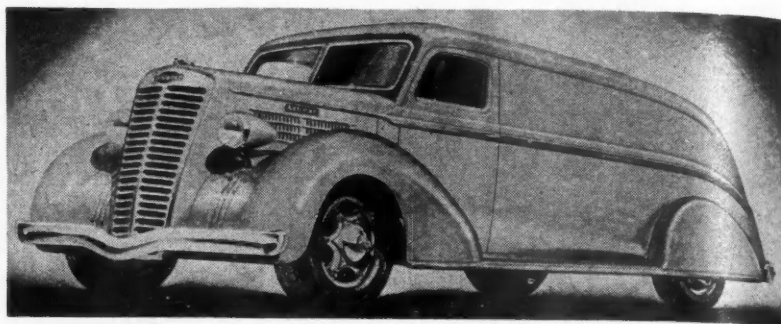
## Autocar Light Trucks

*New Models A and B Are Priced at \$1,095 and \$1,480*

Two new models, A and B, of 13,000 and 16,000 lb. gross rating respectively, have been announced by the Autocar Co. and signalize the entrance of that company into the light-truck field. The move in that direction was started last November when the company announced new models of 18,500 and 20,000 lb. gross rating. With the models now added, which list at \$1,095 and \$1,480 respectively, the company is in position to offer a complete line of trucks.

The new models carry Hercules engines of 263 and 282 cu. in. displacement, respectively, Clark four-speed transmissions, Timken full-floating spiral-bevel rear axles, Timken front axles, Ross steering gears, and four-wheel hydraulic brakes. The brake area is 320 sq. in. in the smaller and 387 sq. in. in the larger model. Each chassis is offered in three wheelbase lengths. Frames are of carbon steel, with maximum sections of 7 15/16 by 2 3/4 by 7/32 in. and 8 by 2 3/4 by 1/4 in. Standard tire equipment consists of 6.50/20-in. tires, dual in rear, and the maximum body length which can be accommodated is 14 ft.

These trucks are equipped with the Autocar deluxe weather-proof cabs. The front springs have the typical Autocar shackle action, the main leaf sliding through a guide bracket with rubber biscuit to take up the wear.



Autocar's new light truck

### Sedan-Limousine and 7-Pass. Sedan Added to DeSoto Line

The addition of a new sedan-limousine to the De Soto line, making a total of 10 body models now available, was announced this week by the De Soto division of the Chrysler Corp. At the same time, the seven-passenger sedan also went into production.

Both the sedan-limousine and the seven-passenger car are built on a 123-in. wheelbase, 3 in. longer than last year's similar models. Two different types of upholstery are offered in the front compartment of the sedan-limousine. When the car is intended for permanent use as a chauffeured car, the front seat and compartment are formally upholstered in black grained leather. If, however, the car's general use is to be as a sedan, with only occasional service as a sedan-limousine, the front compartment can be upholstered in the same material as

the rear compartment.

The glass partition in the sedan-limousine, separating the driver's compartment from the rear, lowers by means of a handle in the back of the front seat. The two auxiliary seats in the rear compartment, folding into the back of the front seat when not in use, are not of the skeleton type, but are well padded and upholstered and a full 23 3/4 in. wide each.

### Sealed Power Promotes Executive Personnel

C. E. Johnson, president of the Sealed Power Corp., has announced several changes in executive personnel.

L. G. Matthews, formerly sales manager, has been advanced to the position of assistant treasurer in place of L. D. Drake, who is no longer with the corporation. Paul R. Beardsley, who with Mr. Johnson founded the business in 1911, is treasurer.

Responsibility for sales will be divided among three men under Neil A. Moore, general manager. They are Paul C. Johnson, manager of original equipment sales; W. O. Banta, manager of replacement sales; John E. Norwood, manager of sales promotion. Mr. Banta is being moved to Muskegon from the west where he has been district manager in charge of California and Arizona. He will be succeeded by W. S. Nichols, who has been his assistant.

### Safety Program Reduced Death Rates in 8 Cities

Estimates of the National Safety Council showing a total of 38,500 traffic deaths in 1936, an increase of 4 per cent, or 1500 over the previous year's total, accompany a new all-time high of 28,000,000 vehicles registered, a new record of 45,000,000 drivers, and an 11 per cent gain in car mileage over 1935, it was said by Paul G. Hoffman, chairman of the Automobile Manufacturers Association Safety Traffic Committee, and president of the Studebaker Corp. "In the face of these unprecedented gains in vehicle registration and use," Mr. Hoffman continued, "19 states made material reductions in their highway deaths as compared with 1935. At the same time, eight of the thirteen U. S. cities of more than a half million popu-

## Passenger Car Production by Wholesale Price Classes

(U. S. and Canada)

Twelve Months 1936 and 1935 Compared

	1936	1935	Per Cent Change	Per Cent of Total	
				1936	1935
Under \$500.....	1,996,490	1,961,679	+ 1.8	52.44	57.91
\$501-\$750.....	1,632,742	1,273,141	+26.2	42.88	37.58
\$751-\$1000.....	122,058	108,517	+12.4	3.21	3.20
\$1001-\$1500.....	39,912	28,232	+41.5	1.05	.83
\$1501-\$2000.....	11,532	8,716	+32.2	.30	.26
\$2001-\$3000.....	4,324	5,413	-20.2	.11	.16
\$3001 and over.....	313	2,108	-85.1	.01	.06
Total.....	3,807,371	3,387,806	+12.2	100.00	100.00

## Truck Production by Capacities

(U. S. and Canada)

Twelve Months 1936 and 1935 Compared

	1936	1935	Per Cent Change	Per Cent of Total	
				1936	1935
1 1/2 tons and less.....	753,881	685,736	+ 9.7	93.13	93.68
2 to 3 tons.....	38,803	34,954	+11.0	4.79	4.78
3 1/2 tons and over.....	8,667	6,442	+34.6	1.07	.88
Special and buses.....	8,135	4,873	+67.0	1.01	.66
Total.....	809,486	732,005	+10.3	100.00	100.00



lation, finished the year with fewer traffic deaths.

"The Safety Council's figures showing a total of 111,000 accidental deaths in 1936 indicate that the best showing in the four principal categories was made by motor traffic with a 4 per cent increase. Accidental deaths in homes totaling 39,000, increased 24 per cent in 1936, while occupational accidents gained 9 per cent in fatalities and miscellaneous accidental deaths rose 6 per cent."

## Arc Welding to Be Feature Of Ohio State Conference

The Department of Industrial Engineering, Ohio State University, Columbus, Ohio, announces that the Sixth Annual Welding Conference and Exposition will be held March 3-5 at Columbus. This conference annually attracts many men interested in manufacture and use of welding equipment.

This year's conference will include a special three-day course in arc welding design and practice. The course will be under the direction of E. W. P. Smith, of Cleveland, Ohio.

## Economy Equipment

### Chevrolet, Ford and Plymouth Offer Options to Fleet Owners

Optional component equipment, designed to provide special performance characteristics and to further the economical operation required of vehicles used in fleet work, is now being offered by Ford, Chevrolet and Plymouth.

Ford does not make any "economy" changes on the 60-hp. V-8 passenger car line, but offers optional equipment for the 85-hp. V-8 passenger car and commercial models.

Two rear-axle ratios are available for the 60-hp. V-8 commercial chassis: 4.44 to 1, which is standard on passenger car and commercial chassis; and 4.11 to 1, which is optional on commercial chassis only.

For the 85-hp. V-8 line, the standard axle ratio for passenger and commercial vehicles is 3.18 to 7. The optional rear-axle ratio is 3.54 to 1. In addition, commercial vehicles for heavy duty can be supplied with an axle ratio of 4.11 to 1.



New type Chevrolet powered 20-25 passenger motor coach introduced by the Flexible Co., Loudonville, Ohio.

Automotive Industries

# Big Truckers Get Most of Business

## East North Central States Census Shows Importance of Hundred Biggest Operators

The sum of \$147,853,000 was received in 1935 by 14,072 concerns with headquarters in the East North Central States whose primary business was motor trucking, it has been revealed by William L. Austin, director, Bureau of the Census.

The 14,072 concerns reported an average of 40,548 persons on their pay rolls for that year. A total of \$49,648 was paid to employees, of which \$64,148,000 was paid to full-time and \$3,500,000 to part-time employees. This did not include compensation to the 13,665 active proprietors and firm members of unincorporated businesses.

The number of vehicles in operation by these concerns in October, 1935, amounted to 52,613, semi-trailers and tractors being considered as separate vehicles.

Analysis of the data for local, intrastate and interstate truckers shows that 81.2 per cent of the trucking concerns reporting were primarily engaged in local operations, 11.2 per cent in intrastate and 7.6 per cent in interstate operations.

By far the larger number of truckers in the East North Central States were small operators. More than three-fifths received less than \$2000 per year and accounted for only 5.4 per cent of the total revenue. Operators receiving from \$2000 to \$9999 per year represented 25.6 per cent of the total, but

received only 9.6 per cent of the income. Thus, 88.6 per cent of all concerns accounted for only 15 per cent of total revenue.

There were 507 concerns in this region, or 3.6 per cent of those reporting, whose annual revenue amounted to \$50,000 or more. These operators received 68.9 per cent of the total revenue. These same concerns operated only 50.6 per cent of the total number of vehicles but accounted for 66.2 per cent of all paid employees and 75.4 per cent of the annual pay roll.

There were 103 concerns that received \$250,000 or more per year. They represented less than three-fourths of one per cent of the total number but received 40.8 per cent of the total annual revenue, employed 37.4 per cent of all paid employees and paid 43.5 per cent of the total pay roll.

The relative importance of a few trucking concerns is emphasized by the number receiving \$500,000 or more per year. There were 42 such concerns in the five East North Central States—less than one-third of one per cent of the total number—yet they accounted for 26.2 per cent of total revenue, paid out 27 per cent of total annual pay roll and sustained 30.9 per cent of total "other expense" (not including depreciation.)

A summary of data by kind of trucking is given below.

### Kind of Trucking

	Total	Local	Intrastate	Interstate
Number of Concerns.....	14,072	11,424	1,576	1,072
Gross Revenue.....	\$147,853,000	\$48,141,000	\$30,874,000	\$68,838,000
Number of Vehicles.....	52,613	24,388	10,030	18,195
Proprietors.....	13,665	11,237	1,516	912
Employees.....	40,548	15,378	8,607	16,563
Pay Roll—Total.....	\$49,648,000	\$16,832,000	\$10,261,000	\$22,555,000
Full-time.....	46,148,000	14,650,000	9,777,000	21,721,000
Part-time.....	3,500,000	2,182,000	484,000	834,000
Other Expenses (not including depreciation).....	71,834,000	17,735,000	15,262,000	38,837,000

A special "economy" carburetor is offered for the Ford 85-hp. engine only. This carburetor has 13/16 in. throttle openings, 0.81 in. venturis and 0.035 in. jets. The standard "economy type" carburetor which Ford adopted in 1936 has 11/16 in. throttle openings, 0.97

in. venturis and 0.045 in. jets.

Modifications of the 1937 Chevrolet engine for fleet application include a carburetor with a main venturi diameter of 1 1/16 in. This is 3/16 in. smaller than the venturi diameter of the carburetor which is supplied with the standard engine. The main jet diameter is also reduced, being changed from the standard of 0.094 in. to 0.0835 in. When this optional carburetor is used, the acceleration of the vehicle above 50 m.p.h. is slightly reduced and the maximum speed is lessened by approximately 5 m.p.h.

The throttle lever of the special carburetor engages a stop pin when the throttle is half open, thus limiting the amount of mixture that can be drawn into the engine.

A sheet steel cover encloses the front half of both the inlet and exhaust (Turn to page 205, please)

February 6, 1937

## Strikers Defy Order

(Continued from page 169)

laws as they find them. The court realizes that no matter what the decision is, it will meet with condemnation. The court will attempt to interpret without giving any opinion as to the merits of the main controversy.

"At the opening of arguments, counsel for the defendant said we are not operating under laws of 1898 but of 1937. It is probable that counsel was referring to the election. But the court must take the law as it finds it.

"The court cannot legislate. The question as to the right of possession is clearly established by the law of the state."

The judge then cited a number of cases of the right of possession being the owner. Some of the cases cited held that the right of possession by an employee ended when the employment ended. A number of Michigan cases to the effect that picketing is illegal either on or in front of a person's property also were cited.

"The defendants here have interposed arguments that the plaintiff did not come into court with clean hands

and that therefore the defendants claim they are justified in their position. The court yesterday asked defense counsel the question of whether two wrongs made a right. The court points out that the court is open to the defendant, if they have been wronged, the same as it is open to all parties.

"The court issues the injunction and commands the defendant to evacuate the premises. And it is further ordered that the defendant be restrained from picketing the plants of the plaintiff. (The two Fisher plants.) The injunction will further provide that the sheriff of the county shall read the order in the premises of the plaintiff which are now occupied by the defendant and such reading shall be sufficient notice to all concerned to evacuate said premises within 24 hours."

## Guide Lamp Resumes Operations

• The first General Motors plant to reopen after being closed by strike was the Guide Lamp Co., Anderson, Ind., where operations were resumed on a limited basis Feb. 2. About 500 of 2600 normally employed were called back to work. Reopening of the plant

was in response to a petition of 2200 of the workers and was accompanied by no untoward incident. It is planned to recall additional men to work as soon as possible until full force is working. The Delco-Remy plant in Anderson, closed because of strikes in other GM plants, reopened Monday, with normal force of 8600 workers.

## Cord Increases Holdings

### Acquires Additional Auburn Stocks and Debentures

Cord Corp.'s investment in Auburn Automobile was increased by approximately 100 per cent, according to the annual report. The increase, it is explained, was accomplished through purchase of additional stock and a substantial portion of the debentures which Auburn floated late in 1935 and early in 1936.

The investment in Auburn was carried in the report at a total cost of \$4,585,351, compared to a market value as of November 30, of \$3,707,951. During the year Cord acquired 16,302 additional shares of Auburn stock, which was purchased at an average cost of \$39 a share. Its total holdings are 65,122 shares, or slightly over 28 per cent of the issue.

In addition to the stock, the company held \$1,695,913 par value of Auburn 4 1/2 per cent convertible debentures—nearly 65 per cent of the total issue.

The price paid for the debentures was given as \$1,712,544. The market value of the debentures on Nov. 30 was \$1,526,321.

Other holdings by Cord Corporation in affiliated companies are given in the report as: Aviation Corporation, 825,372 shares, costing \$3,534,954, with a market value on Nov. 30 of \$4,952,232; Checker Cab Manufacturing Co., 32,430 shares, costing \$227,377, with a market value of \$1,653,930; New York Shipbuilding Corporation, 46,200 shares, costing \$917,488, with a market value of \$415,800.

The Cord report showed a profit of \$306,691 after charges and taxes, which is equivalent to 13 cents a share on 2,256,700 shares of capital stock outstanding. In the 1935 fiscal report a loss of \$242,451 was noted.

## Safety Glass Production Well Underway in Toledo

Production of safety glass at Libbey-Owens-Ford Glass Co. plants is well under way following settlement last week of a six weeks' strike. The Toledo plants were all in operation but some difficulties were encountered at Ottawa, Ill., plant when union members declared committee representatives had not come through with promised results.

## Hercules Motors "Sitdown" Ended by One-Year Contract

Operations at the Hercules Motors Corp., Detroit, will probably be resumed Feb. 8. The 56-day sitdown strike ended with the acceptance of a one-year contract, returning 1700 employees to their jobs.

The contract, approved at a Union meeting, after the men inside the plant had indicated their agreement, calls for recognition of the Committee for Industrial Organization Union as a bargaining agency for its members. Company officials said such recogni-



Copyright 1937 by Chilton Co., Inc.



tion was offered before the strike.

Other stipulations written into the contract were: consideration of wage increases three months hence, if business conditions warrant, and possible adjustments in piecework rates.

The strikers had demanded recognition as the sole bargaining agent and a blanket wage increase.

## GM Reduces Dividend

### First Quarter Dividend of 25 Cents Declared on Common Stock

Reflecting effects of the prolonged sitdown strike and resulting uncertainty as to first quarter earnings, the directors of General Motors Corp. Feb. 1 declared a dividend of \$0.25 per share on the outstanding common stock, payable March 12 to stockholders of record Feb. 11. The regular quarterly dividend of \$1.25 per share was declared on the \$5 preferred stock payable May 1 to stockholders of record April 5.

The 25-cent dividend compares with 50 cents a share paid last March; 50 cents quarterly and 75 cents extra in June and September together with a year-end dividend of \$1.50, making a total for 1936 of \$4.50—the largest amount ever paid on the present stock.

Officers of the corporation declined to comment on the lower rate and would not indicate whether the reduction comes as a result of the strike. Another possible explanation of the smaller payment is that the corporation may follow an "interim" dividend policy similar to that announced recently by E. I. du Pont de Nemours, by which a final year-end dividend, following moderate quarterly dividends, will take care of surplus earnings in order to avoid a heavy excess profits tax.

### GM's Canadian Operations Retarded

Plants of General Motors of Canada, Ltd., are still operating, but at slow tempo—waiting and hoping for the stampings and other essential parts that must be forthcoming from the United States before production can once more be resumed. Current activity has pretty well narrowed down to Oldsmobile, Pontiac and trucks, it is reported. The chief aim is to avoid a complete shut-down if at all possible.

### U.A.W. Claims Chrysler Victory

Elections held at the Chrysler plants last week resulted in a victory for the United Automobile Workers Union, according to Richard T. Frankenstein, Detroit organizer. Union candidates won control in the employee representative system which had been set up by the old Automobile Labor Board. Results of the election, announced by Frankenstein, showed that the union had won 12 out of 23 posts on the collective bargaining committee at the Plymouth plant; all 12 delegates at the Kercheval plant of Chrysler; 7 out of 14 at the Jefferson plant of Chrysler; 7 out



Judge Paul V. Gadola  
Ordered Strikers to Evacuate  
GM Plants

of 8 at the DeSoto plant; and an estimated 46 out of 52 at the Dodge plant, returns from which are not all tabulated.

Dodge workers voted to demand 75 cents an hour minimum. A program leading to elimination of labor spies is also under consideration by the Dodge local. No demands have been presented to management as yet.

### Jan. Total 400,000

(Continued from page 169)

ened pace even if GM had been in the race, since practically all had heavy banks of unfilled orders that called for the schedules they had set up.

Last month's production activity reflects not only an expanded market this year but also the enlarged facilities which factories have provided to handle a larger volume.

The GM strike was not the only limiting factor in the January production. All Chrysler divisions were forced to lose a day on account of glass shortage. Other plants experienced material shortage and lost a day or two of operation. The flood threw out of production two Ford assembly branches and one Chrysler branch for a week or more last month. The Ford Cincinnati branch and the Chrysler plant at Evansville are now resuming operations. Interruption to shipments into the flooded area also had some influence on production.

Factory schedules for February indicate that production of companies operating will be fully as large if not slightly larger than in January. With the glass strike settled, operations this month will not be handicapped by glass

shortage. General Motors currently is entirely out of the picture so far as passenger cars are concerned and at this time no prediction can be made as to when the corporation will be back in the running. Accumulated stocks of bodies and parts enabled some of the divisions to carry on assembly work for a time in January although the strike had tied up key plants.

Under the back to work plan, several GM divisions are now building up huge inventories of parts both for assembly and service. Pontiac, for example, already has stored 18 months' requirements of service parts. Loyal workers are also engaged in extensive plant repairs and in revamping assembly lines for more efficient operation.

Studebaker truck sales in 1936 totaled 6473, a gain of 34 per cent over the largest previous year, 1931, when 4845 were sold, Paul G. Hoffman, president, has announced. Sales in 1935 were 4760.

### Operations Back to Normal At City Auto Stamping Plant

City Auto Stamping Co. operations were back to normal Wednesday after 500 members of the day shift took a vacation and went to Flint, to help fellow members of United Auto Workers. They asked permission of management to take the day off but were denied. The plant is operating on three shifts. Afternoon and night shifts worked as usual. There was no hard feeling over the matter. Company officials, however, consider the walkout a violation of the working agreement.

### Mr. du Pont Approves

The conduct and policies of the General Motors Corp. with regard to the strike have the complete approval of Pierre S. Du Pont, chairman of the board of E. I. Du Pont de Nemours and Co., which holds about one-fourth of the General Motors Corp. common stock. Mr. Du Pont declared himself entirely in accord and gave his unqualified personal support of General Motors policies in the current automotive strike today. "I endorse the position taken by the company in the strike situation. I am perfectly satisfied," he said.

The Delaware financier whose efforts had much to do with the creation of the General Motors combine expressed belief that the majority of General Motors Co. stockholders sympathized with his point of view. He qualified his assertion, however, when he added, "I have no definite information on the subject." Six members of the Du Pont family including Pierre are directors of the General Motors Corp.

# Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for AUTOMOTIVE INDUSTRIES

Despite the retarding influences of the floods and the automobile strike, general business made a good showing last week. The weekly business index of the "Journal of Commerce" stood at 96.2, as compared with 96.4 the week before and 72.8 a year ago. Retail trade was estimated from 8 to 12 per cent above that in the corresponding period last year, while wholesale business gained from 15 to 20 per cent.

## Car Loadings Off

Railway freight loadings of the first seventeen major railroads to report for the week ended Jan. 23 totaled 315,702 cars, as against 329,163 cars in the preceding week and 270,560 cars a year ago.

## Electricity Production Up

Production of electricity by the electric light and power industry in the United States during the week ended Jan. 23 was 15.7 per cent above that in the corresponding period last year.

## Construction Awards Jump

Construction contracts awarded in December in 37 eastern states last year, according to the F. W. Dodge Corp., amounted to \$2,675,296,000, which marks an increase of 45 per cent above the total for 1935. Residential building alone showed an increase of 67 per cent.

## December Employment High

The upturn in employment in manufacturing and non-manufacturing industries which commenced in Feb., 1936, continued during December, according to the Bureau of Labor Statistics. Approximately 470,000 additional workers found employment in these industries during the month, while weekly payrolls rose by more than \$14,100,000.

## Farm Prices Rising

According to the Bureau of Agricultural Economics, farm prices rose during the month ended Jan. 15. Heavy European purchases of wheat during December caused a sharp advance in the price of this commodity.

## Fisher's Index Firm

Professor Fisher's index of wholesale commodity prices for the week ended Jan. 30 stood at 90.4, as compared with 90.2 the week before and 90.7 two weeks before.

## Gold Stock Augmented

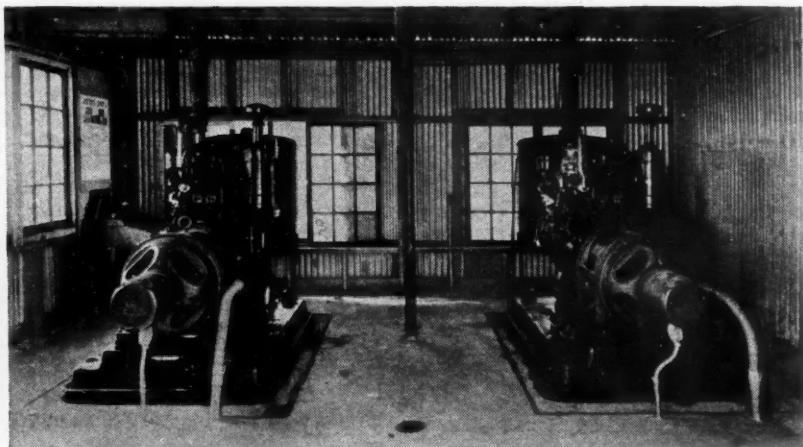
The consolidated statement of the Federal Reserve banks for the week ended Jan. 27 showed an increase of \$1,000,000 in holdings of discounted bills. Holdings of bills bought in the open market and of government securities remained unchanged. The monetary gold stock rose \$28,000,000, and money in circulation declined \$21,000,000.

## Bonneville Cafe Lighted By Low-Cost Diesel Power

An interesting application of Caterpillar Diesel engines is found at the State-line cafe and service station operated by W. F. Smith on the rim of the Bonneville Salt Flats. This place is a rendezvous for race drivers and me-

chanics in their assaults on time records.

The station has its own powerplant supplying current for garage machinery, refrigeration and lighting. Two 60 hp. Caterpillar Diesels have been installed for this purpose, each engine being run 100 hours during alternate periods, the idle engine being drained of



The Bonneville Salt Flats cafe and service station, well known to automobile racers, is lighted by power from two Caterpillar D6600 Diesel engines shown above. Operating cost is reported less than one cent per kw. hr.

lubricant while standing by. The engines are direct-connected to Westinghouse 31.3 KVA 240-volt alternators. The units are housed in a neat engine room which includes a panel board equipped with Square-D switches.

According to Proprietor Smith, the operating cost is only 20.5 cents per hour. Cost of fuel oil laid down at the station is 9 cents per gal. while fuel consumption is 2 gal. per hour. Lubrication costs 2.4 cents per hour. This plant is producing current at the extremely low rate of less than 1 cent per Kw-hr.

## Indian Trailer Announces Safety Steel Coach at \$495

The Indian Trailer Corp., Chicago, is now producing its new line of safety steel coaches, according to an announcement by the president, H. J. Meister. The Indian Scout De Luxe, completely equipped and "ready to live in," is priced at \$495.

## 40 Years Ago

—with the ancestors of  
AUTOMOTIVE INDUSTRIES

## The Horsepower Required

A year ago we were trying to make every part of the motor and carriage light. We reasoned that if two horses could draw a carriage and two people at a speed of 7 or 8 m.p.h., a 2-hp. motor would be sufficient for a single-seated motor carriage. Experience has proven the fallacy of such reasoning.

In figuring the power required to propel the motor carriage we have not taken into consideration the fact that besides carrying two men and the carriage the motor must also be carried and in order to do this the carriage must be stronger and heavier than one used with horses, and the motor must be of sufficient horsepower to propel this heavier carriage on bad roads and up hill. We have thought of the horse when we made a 2 hp. motor and considered it as powerful as two horses. This might be true at a speed of 7 m.p.h. but as soon as the speed is reduced below this the horse is enabled to exert more of his power in available work.

In summing up our experiences we must conclude: that 6 or 8 hp. is necessary to successfully propel a light carriage weighing 800 lb.; that strength and durability should not be sacrificed in order to make a light motor; that there is as much difference in gasoline as there is in men and that good gasoline and good management are necessary to the successful working of the motor.

—From an article by M. H. Daley in *The Horseless Age*, February, 1897.



## Jap Designs Air Engine

*Supercharged 9-Cyl. Radial Unit  
Develops Over 300 Hp.*

In the presence of high officials of the Aircraft Bureau of the Ministry of Commerce and Industry, Tokyo, the Tokyo Gas & Electric Industry Company, Ltd., recently gave a demonstration of a new type radial airplane engine designed by Masami Fukutaki of this company. It is reported that after the 50-hr. test run the engine showed no signs of wear in the cylinders.

The new engine is a nine-cylinder supercharged unit, with a 5.3 compression ratio. It is rated 240 b.h.p. at 2100 r.p.m., and 285 b.h.p. at 2300 r.p.m. In the 50-hr. test it carried a load of 315 b.h.p. at 2300 r.p.m.

It is further reported that the engine, known as the "Shimpu," or "Divine Wind," is to be entered for the 600-hr. contest to be held under the auspices of the Ministry of Commerce and Industry early next year. A prize of 30,000 yen will be granted to the manufacturer of the most successful craft.

The design of the new engine is based on that of the Shimpu-3 which a few years ago won the prize offered by the Government for the first completely native-built, radial, air-cooled, aircraft engine. The earlier engine had seven cylinders and developed 150 b.h.p.

## Japanese Diesel Company Employs German Advisor

Franz Schneider, former head of the Schneider Airplane Co., has arrived in Japan to become chief advisor to the Second Japan Diesel Engineering Co. This company, since the visit of its president, Kenzo Adachi to Germany last year, has been closely allied with the Krupp-Junkers interests. The 65-year-old German industrialist began his studies of aviation in France before the World War, and has since been active in German automotive industries.

The fact that a prominent German industrialist relinquished the management of his own concern in order to become advisor to a Japanese engineering firm has caused quite a sensation in both Japanese and foreign circles in Tokyo. He is reported to have said that he expects to remain in Japan permanently.

## Value of Canadian Vehicle Sales 16% Higher Last Year

An increase of 13 per cent in volume and 16 per cent in value is shown in new car sales in Canada during 1936 compared with the previous year. New cars sold totaled 114,641 worth \$118,238,385 against 101,461 valued at \$101,742,449 during 1935. Passenger cars numbered 94,203 worth \$97,238,284 compared with 83,242 at \$83,429,114 in 1935, and trucks totaled 20,438 valued at \$21,000,101 against 18,219 at \$18,313,335.

*Automotive Industries*

Automobiles produced in Canada during 1936 numbered 162,322 of which 108,745 were for sale in Canada and 53,577 for export. This compared with 172,877 cars produced in 1935 of which 103,529 were for sale in Canada and 69,348 for export.

## British Output Higher

*October-November Production  
14.6% Above Period Year Ago*

The January monthly progress report of the Society of Motor Manufacturers shows that British production for October and November (the first two months of the current fiscal year) amounted to 81,112 units (passenger cars 61,537, trucks and buses 19,575), which represents an increase of 14.6 per cent over the total for the corresponding months of 1935. During the whole of 1935-36 (Oct. 1-Sept. 30) the in-

crease was 14.4 per cent, so that the rate of increase is being maintained with a little to spare.

Passenger car production alone represented an increase of 10.6 per cent against 13.5 per cent in 1935-36, and that of trucks and buses an increase of 30.2 per cent against 17.8 per cent.

Domestic sales of cars showed an increase of 6.0 per cent in both October and November, but truck and bus sales increased by 25.9 per cent in October and 18.6 per cent in November.

A notable increase occurred in the number of passenger cars exported during October and November, 86 per cent in comparison with the same months of 1935. Truck and bus exports also increased by approximately 26 per cent.

## GM to Give Big Canadian Bonus

General Motors of Canada, Ltd., Oshawa, Ont., will distribute \$465,000 as a bonus among 1120 Canadian employees, it is understood.

## West, Meet East!

*Here Are the Men Behind Japan's Bid for a  
Place as an Automotive Manufacturing Nation*

### 5. Takaichi Fukui.

The reorganization of the Ota Jidosha Co., of Tokyo, last summer under the new name, High Speed Engine Manufacturing Co. (Kosoku Kikan Kogyo Kabushiki Kaisha), was an event of considerable importance in the Japanese automotive world. It marked the entrance for the first time of the nation's No. 1 business family—the Mitsui—into the automotive manufacturing field.

When the Mitsui need a man for an important executive post, the manager of the New York branch is usually called upon to propose a candidate. In fact, the New York office of the Mitsui Bussan is considered a sort of training school for future Mitsui directors. Only the most promising youths are sent there, few are allowed to stay longer than three years, and those who do are thereby tagged for an executive career.

Takaichi Fukui had just completed his seventh year in New York when he was ordered back to take charge of the new High Speed Engine Co. His first act on returning was to stop the amateurish production of passenger cars in the old Ota shops. New engines were developed and improved manufacturing equipment, specially imported by Mitsui, installed. Fukui's idea is to build as many experimental cars as possible and try them out in speedway competitions before actual production gets under way.

Experimental Otas have made a remarkable showing against both domestic and foreign built cars during the past few months. Many of the features thus proved on the speedway will be incorporated in the stock job about to be marketed.

Mr. Fukui's love of automobile racing may be understood when his own brilliant record in the field of sports is considered. In the Third Far Eastern Championship Games he scored records in the 100 and 200-metre high and low hurdle events.

(This is one of a series of six brief biographies of Japanese automotive manufacturing executives.)



Takaichi Fukui

February 6, 1937

# Stainless Steel Sleeper Bus

*Budd Builds 14-Passenger, Air-Conditioned Unit for  
Desert Run Between Baghdad and Damascus*

A light-weight, stainless steel sleeper bus of 14-passenger capacity, air-conditioned and designed for desert travel, has been delivered by the Edward G. Budd Mfg. Co. to the Nairn Transport Co., Ltd., for use in the Syrian desert between Baghdad and Damascus.

The sleeper unit is the first of its type ever constructed, and was specially designed to operate under the extreme temperatures and road conditions encountered in the 600-mi. desert run, where only 200 mi. of the route follows established road.

Pulled by a 150 horsepower Diesel tractor, the unit will cut nine hours from the 24-hr. schedule now in effect between the two cities. The bus has a top speed of 65 m.p.h.

The power unit was built by the Van Dorn Iron Works, Cleveland, and the air-conditioning equipment and interior finish was installed by Fitz Gibbon and Crisp, Trenton, N. J. The Firestone Rubber Co. constructed special tires carrying from 25 to 30 lb. of air for use on the tractor and trailer.

Over all length of the trailer and tractor is 57 ft. 6 in. and that of the trailer alone 36 ft. 8 in. Over all height when loaded is 8 ft. 7 in. The bus has a weight of 28,000 lb.

At the point of attachment to the Cromansil spring hangers and 72-in.

springs, the floor beams are increased in size to meet the loading conditions, while a strong alloy cross member is built into the body at the lower edge of the front cut-out for reinforcement against striking the ground.

At points where the structure is cut, such as around the rear axle and front end, reinforcements are added to reduce the localized stresses.

The roof is of standard semi-trailer design, except that, in order to secure more attractive over all lines on a vehicle of this size, the rear end is pointed. Side-frames are of semi-trailer stress skin construction, and two longitudinal purlines to which the bulkheads are attached run the entire length of the body. These are Z-shaped sections, welded to carlines and serve the purpose of increasing the longitudinal stiffness of the bulkheads.

Two entrance doors are provided, one on the right side, and another in the rear of the bus. The location of the 17 windows provides two window openings in each sleeper compartment. There is a window over the wheel housing and one in front, and two in the rear.

The bus is equipped with the Houdaille shock absorbers, and provision is made for the application of a rubber bumper to limit the travel of the rear axle.

Special tires, size 300 by 20, made by the Firestone Co., are 10-ply instead of the usual 14-ply. Two spare tires are carried in the tractor unit.

Air brake equipment is mounted on the axle, an unusual feature on vehicles in desert service where the custom is merely to shut off power and coast to a stop. The brake, however, adds to the versatility of the equipment, enabling it to be operated in a mountainous country should such special service be required.

All joints are soldered, cemented, or painted and thoroughly water-tested so that they cannot leak or breathe dust. The inside walls are of ¼-in. birch plywood, screwed and cemented to the battens. The wood floor, covered with linoleum, is cemented to the Phenaloid sub-floor, while the cover-pan is bolted over the entire bottom surface of the body. It is made of 20-gage galvanized iron, sound-deadened with Hydrolin (or Voltex Cork Cement). Between the side lining and the outer sheathing, there is 2½ in. of Kapok insulation. In the roof there is 3 in. of Kapok, having a muslin cover.

Individual air-conditioning ducts run to the upper and lower berths. The ducts to the lower berths, 2 ft. by 3 ft. in size, extend down to the edge of the partition between the seats and serve as stiffener columns at this point. The air conditioning equipment supplies outside air through a grille in front of the trailer body at approximately 50 CFM for each berth.

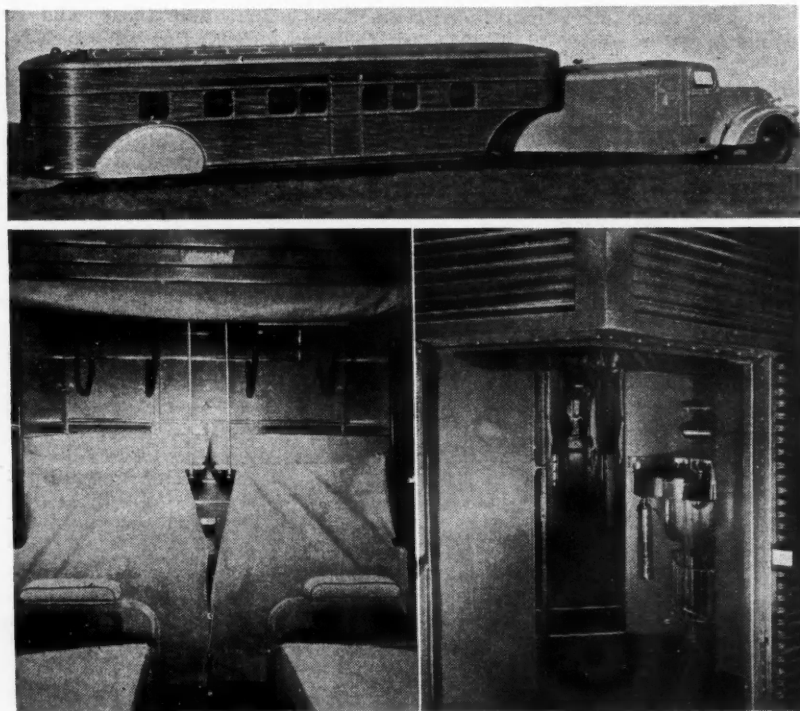
Each compartment, though large enough to seat four, is designed to accommodate but two persons. Most of the 15-hr. ride will be made after night-fall, but there will be several hours in both the morning and evening when passengers will prefer to sit up. The upper berths are readily convertible into double facing seats.

## :SLANTS:

**CIVIL WAR**—Spain and China aren't the only countries with civil wars raging—we ourselves have a "war between the states" just now, bloodless it is true. Border conflicts, caused mainly by efforts to levy special fees and taxes on motorists crossing state lines, have been revealed by the National Highway Users Conference. Nine states already have established inspection stations similar to those found on European frontiers, and motorists are beginning to protest against delays and expenses incurred in crossing state lines. So far, there is no sign of abatement—rather, the "war" is being extended through "reprisals" taken by adjoining states.

**FORD PROTEST**—The Ford Motor Co. has registered a protest with the two major broadcasting companies against the practice of injecting extraneous commercial announcements immediately preceding or following Ford radio programs.

Basing its complaint on the fact that



(Top) Exterior view of the sleeper trailer built by Edward G. Budd Co. for the Nairn Transport Co., Ltd. (Lower, left) Side view showing compartments. (Lower, right) View through rear door showing dressing room and lavatory



the sponsor of a unit of time is entitled to the attention of his audience, the official protest states in part:

"The practice of slipping in extraneous commercial spots, we feel, is unfair to the sponsor and to the public. We have received numerous complaints substantiating this, and believe the time has arrived for broadcasting companies to take cognizance of this situation."

## SAE Sets Standards Proposal For Tourist Trailer Couplings

Standards for tourist-trailer couplings have been proposed by an S.A.E. Committee and are being circulated to automobile and trailer manufacturers for note and comment. The committee has proposed that

1. Unless the rear bumper of the towing car is designed to carry the coupling unit, the coupling unit shall not be attached to the bumper—it shall not be located outside of the bumper—and it shall allow a minimum clearance of 3 in. between the bumper bar and the unit.
2. From the safety point of view, the coupling connection to the trailer shall be above the bumper, not under.
3. There shall be two standard coupling sizes, No. 1 for gross loads on the coupling up to and including 5000 lb., and No. 2 for gross loads over 5000 lb.
4. There shall be a standard minimum strength test for couplings as follows: longitudinal tension and compression of

15,000 lb.; vertical tension and compression of 7000 lb., and transverse thrust of 7000 lb. for the No. 1 size coupling and twice these values, respectively, for the No. 2 coupling.

It was agreed that the dimensional part of the proposed standard should give only the bracket or mounting platform on the towing car to which the coupling unit would be attached. This platform for each car model would be designed or provided for by the car manufacturer, while the trailer manufacturer would furnish the coupling unit, including the ball that would fit into the standard platform. The following are proposed tentatively:

1. The upper surface of the platform shall be at least 18 in. and not over 20 in. from the ground with the car half loaded and before connecting the trailer.
2. The coupling platform shall be horizontal and shall be steel plate, ½ in. thick plus ¼ in., minus zero.
3. The drilled hole in the platform shall be ¾ in., ½ in. or 1 in. diameter for the No. 1 coupling and 1, 1½ in. or 1¾ in. for the No. 2 coupling, the tolerance on the hole diameter to be plus 0.002 in., minus 0.000 in. (A single correct hole diameter for each size coupling will be worked out by the committee on the basis of the minimum strength requirements.)

## Export Men Urge Extension Of Reciprocal Trade Agreement

Whole-hearted endorsement of legislation proposing a three-year extension of the Reciprocal Trade Agreements program in its present form was given at a meeting of export leaders of the Automobile Manufacturers Association in the Hotel Statler on Feb. 2.

# 12 Months' Exports \$240,205,262

Exports and Imports of the Automotive Industry for December and Twelve Months Ended December, 1936-1935

	DECEMBER		DECEMBER		TWELVE MONTHS ENDED DECEMBER			
	1936		1935		1936		1935	
	No.	Value	No.	Value	No.	Value	No.	Value
<b>EXPORTS</b>								
Motor vehicles, parts and accessories.....		\$ 28,769,239		\$ 19,722,925		\$ 240,205,262		\$ 227,290,219
<b>PASSENGER CARS</b>								
Passenger cars and chassis.....	24,647	14,389,012	17,736	9,378,181	179,957	103,024,254	173,881	94,974,025
Not over \$850.....	22,629	12,175,443	16,545	8,110,802	165,501	86,788,566	161,535	81,867,580
Over \$850 to \$1,200.....	1,650	1,561,036	842	784,475	11,758	11,238,263	8,759	8,304,968
Over \$1,200 to \$2,000.....	277	419,586	208	311,405	1,817	2,722,621	1,463	2,224,426
Over \$2,000.....	91	232,937	57	132,946	881	2,274,784	815	2,113,783
<b>COMMERCIAL VEHICLES</b>								
Motor trucks, buses and chassis (total).....	10,483	5,727,433	10,276	4,664,174	105,799	54,764,366	99,080	50,582,436
Under one ton.....	1,401	521,844	1,006	345,262	15,710	5,987,790	9,982	3,369,120
One and up to 1½ tons.....	7,156	3,377,066	8,312	3,498,436	71,305	32,890,323	72,103	32,813,663
Over 1½ tons to 2½ tons.....	1,445	1,301,272	771	602,511	13,849	10,550,312	14,057	10,380,179
Over 2½ tons.....	235	419,651	153	185,296	2,807	4,307,258	2,403	3,871,815
Bus chassis.....	246	107,580	17	23,623	2,126	1,028,683	286	321,629
<b>PARTS, ETC.</b>								
Parts except engines and tires.....								
Automobile unit assemblies.....		4,901,282		2,553,717		41,365,369		44,473,196
Automobile parts for replacement (n.e.s.).....		2,200,675		2,157,562		26,529,397		26,358,207
Automobile accessories (n.e.s.).....		446,962		186,303		3,513,134		3,080,436
Automobile service appliances.....		405,435		303,739		4,607,481		4,053,707
Airplanes, seaplanes and other aircraft.....	65	1,988,614	11	434,746	490	11,299,451	333	6,598,515
Parts of airplanes, except engines and tires.....		416,508		278,967		6,060,483		5,069,810
<b>INTERNAL COMBUSTION ENGINES</b>								
Stationary and Portable.....								
Diesel and semi-Diesel.....	52	122,164	30	175,376	422	1,112,139	331	978,474
Other stationary and portable.....								
Not over 10 hp.....	1,410	80,415	1,318	45,990	13,730	791,575	10,196	570,016
Over 10 hp.....	119	73,997	99	67,147	2,193	1,001,883	1,410	812,700
Automobile engines for.....								
Motor trucks and buses.....	1,662	169,759	2,435	213,471	21,990	2,149,395	9,251	1,004,196
Passenger cars.....	7,376	514,003	3,191	231,083	48,154	3,305,862	29,193	1,996,908
Engines for aircraft.....	160	1,061,252	14	67,003	945	5,397,469	568	2,459,317
Accessories and parts (carburetors).....		161,754		125,202		1,940,517		1,598,908
<b>IMPORTS</b>								
Automobile and chassis (durable).....	94	59,065	41	15,067	1,075	558,979	591	281,465

## Fewer GM Accidents 26% Improvement Over 1935 Safety Record

Factory employes of General Motors had fewer accidents at work than they did in the hours spent outside the plants during 1936, according to insurance and safety statistics just compiled by the corporation.

In announcing that there were fewer claims filed for compensation as a result of industrial accidents than there were for non-occupational accidents, General Motors made public figures showing that 1936 was the best year in its history from an industrial safety standpoint.

With more than 373,000,000 hours of work during 1936, the 78 manufacturing plants of General Motors reported only 5.19 lost time accidents per million hours worked, an improvement of 26 per cent over the 1935 record. In the severity of accidents, the time lost by employes was 0.664 days for every thousand hours worked, a reduction of 13 per cent under 1935.

An average of 195,232 employes of General Motors were protected under a group insurance provision for accident and health claims during 1936, compared to 176,014 employes during 1935. Claims resulting from accidents outside the plants during 1936 were approximately 10 for each 1000 employes, while compensable lost-time accidents within the plants were less than seven for each 1000 factory employes.

## Electric Auto Lite Prospectus Sets Flood Loss Below \$75,000

The Cincinnati plant of the Electric Auto-Lite Co. has been closed since Jan. 23, due to the flood. As stated in the company's listing application filed with the New York Stock Exchange, covering 200,000 shares of stock to be used in conversion of the new issue of \$10,000,000 of 4 per cent debentures, it is impossible to determine the ultimate loss.

According to the application, the loss not covered by insurance will be less than \$75,000. It adds further, that if the company is able to resume by the middle of February no serious operating loss will be incurred.

## Chrysler Begins Service Program

Importance of proper maintenance and service of a car to the driver's safety are being emphasized at 650 meetings of Plymouth, Dodge, DeSoto and Chrysler dealers and service managers now being held in 250 cities through the United States. The program was developed by T. W. Moss, general service manager, Plymouth, Dodge, DeSoto and Chrysler.

Driver safety will be emphasized in this nation-wide series of meetings.

# Automotive Metal Markets

## Steel Market Outlook Still Hazy; Week's Rate of Steel Mill Operations Reported at 79.6 Per Cent of Ingot Capacity

By William Crawford Hirsch

The outlook in the steel market, in so far as automotive business is concerned, continues hazy. Announcement by some sheet producers that they are in no position to book additional orders for shipment during the current quarter and that second quarter business can be accepted only on the basis of buyers agreeing to pay whatever the price will be at the time of shipment after April 1, is interpreted as a protective move on the part of sellers rather than as notice that further price advances are under consideration at this time.

Aside from tonnages under suspension as the result of "hold" orders, the backlogs of a number of sheet mills are tapering off. Other plants have enough business on their books to carry them through March, but the situation with reference to second quarter business has hardly developed sufficiently to permit of formulating any definite price policy at this time.

Recurrently reports crop up that the Lewis organization plans to stage in the very near future an attack on the steel industry, similar to that in the automobile manufacturing field. A good deal of steel, perhaps more than ever before, is therefore being stocked. Strip mills are whittling down what orders they have on their books, aside from the temporarily suspended business of General Motors and its suppliers.

This week's rate of steel mill operations, reported by the American Iron and Steel Institute at 79.6 per cent of ingot capacity, indicates that flood conditions have not greatly impaired steel production. In the Detroit area, where operations of steel mills continue virtually at capacity, there was some talk of business being transferred there to lighten the burden on mills repairing flood damage.

Announcement is made by the American Iron and Steel Institute that 85 steel producing companies, representing 90 per cent of total capacity, plan to expend \$290,000,000 in new construction and equipment this year. This expansion is made necessary chiefly by increased demand for steel used in the manufacture of automobiles.

**Pig Iron**—Automotive foundries are not very active just now in the pig iron market which, however, rules firm.

**Aluminum**—Aluminum production in the United States last year aggregated 102,027 metric tons, an increase of 89 per cent over the preceding year's output. Germany's aluminum production last year totaled more than 95,000 tons, an increase of 24,500 tons over 1935. The market for both primary and secondary aluminum is steady and unchanged.

**Copper**—Prices in London began to shoot upwards again this week, the export price on Monday being reported  $\frac{1}{2}$  cent higher at 12 $\frac{1}{2}$  cents. Were it not for the gap in consumption, caused by the General Motors strike, another upward movement in the

price here, it is thought, would have taken place before this. As matters stand, an advance would not come as a surprise.

**Tin**—Steady, with spot Straits being quoted at the beginning of the week at 49.90 cents. The statistical position of the metal indicates a more adequate supply.

**Lead**—Quiet and unchanged.

**Zinc**—Steady.



Much information of practical value to users or prospective users of cemented carbide tools is contained in an engineering bulletin just issued by Carboly Co., Detroit, on the subject of proper carbide grade selection.\*

The Sundstrand Machine Tool Co., Rockford, Ill., has brought out a folder which contains a complete description of the Sundstrand automatic No. 2 electromil.\*

A paper by Peter Hidnert entitled "Thermal Expansion of Lead-Antimony Alloys," which originally appeared as part of the Journal of Research of the National

Bureau of Standards, Vol. 17, Nov., 1936, is now available in pamphlet form from the Superintendent of Documents, Washington, D. C. Price 10 cents.

The Copper Development Association, Thames House, Millbank, London, has just made available in booklet form an article by H. J. Miller entitled "High Tensile Strength Brasses or Manganese Bronzes." This article originally appeared in the *Metal Industry*, issues of Aug. 28 and Sept. 4, 1936.

The "Thomas National Trailer Park Directory," a guide to approximately 1000 trailer parks in the United States and Canada, has recently been announced as available by the Trailer Coach Manufacturers Association, Peoria, Ill.\*

The New Departure division of General Motors Corp., Bristol, Conn., has issued a descriptive pamphlet on the Transitor variable speed transmission.\*

\* Obtainable from the editorial department of AUTOMOTIVE INDUSTRIES, Address Chestnut and 56th Sts., Philadelphia.

## Chicago Show Nov. 6-13

The 38th Annual Chicago Automobile Show is to be held at the International Stockyards Amphitheater, Nov. 6 to 13, according to an announcement by K. K. Kenderdine, president of the Chicago Automobile Trade Association.

## Fink Named Mack President

E. C. Fink, formerly vice-president of Mack Trucks, Inc., has been elected president and chairman of the board to succeed the late Charles Hayden. Clarkson Potter, of Hayden, Stone & Co., has been elected a director of Mack Trucks, Inc., to fill the vacancy created by the death of Mr. Hayden.

## Calendar of Coming Events

### SHOWS

- Automobile Show, Berlin, Germany, Feb. 20-March 7
- Hungary, International Automobile, Motorcycle and Motor boat Exposition, Budapest ..... March
- Austria, Automobile and Motorcycle Salon, Vienna ..... March 7-13
- Switzerland, 14th International Exposition, Automobiles, Motorcycles and Bicycles, Geneva ..... March 12-21
- Portugal, 11th Automobile Salon, Porto March 27-April 5
- Illinois Automotive Ass'n, 4th Annual Show and Maintenance Exhibit, Navy Pier, Chicago ..... Apr. 24-28
- Poland, Automobile Salon—16th International Fair, Poznan ..... May 1-10
- Norway, Automobile Salon—Oslo ..... May 7-10
- Second Annual Automotive Maintenance Show, San Francisco ..... May 20-23
- Belgium, First International Aeronautical Salon, Brussels ..... June 18-30
- Fourth ASTM Exhibit of Testing Apparatus and Related Equipment, New York ..... June 28-July 2
- Poland, Automobile Salon (Foire Orientale), Lwow ..... Sept. 1-15
- France, 31st International Automobile Salon, Paris ..... Oct. 1-17
- Great Britain, 31st International Automobile Exposition, London ..... Oct. 14-23
- National Automobile Show, New York, Oct. 27-Nov. 3
- Italy, 10th International Automobile Salon, Milan ..... Oct. 28-Nov. 8
- Great Britain, 13th International Commercial Automobile Exposition (trucks and buses), London ..... Nov. 4-13
- Chicago Automobile Show ..... Nov. 6-13
- Great Britain, 36th Scottish International Automobile Exposition, Glasgow ..... Nov. 12-20

### CONVENTIONS AND MEETINGS

- Tin Can Tourists' Winter Convention, Sarasota, Fla. .... Feb. 8-14
- Association of Highway Officials of No. Atlantic States, 13th Annual Convention, New York ..... Feb. 24-26
- American Society for Testing Materials, 1937 Regional Meeting and Committee Week, Palmer House, Chicago, March 1-5
- Sixth Annual Welding Conference and Exposition, Ohio State University, Columbus, Ohio ..... March 3-5
- International Association for Testing Materials, Second International Congress, London, England ..... April 19-24
- SAE National Tractor and Industrial Power Meeting, Peoria, Ill. .... April 21-23
- 41st Annual Convention and Exposition of the American Foundrymen's Association, Milwaukee ..... May 3-7
- American Society of Mechanical Engineers, spring convention, Detroit, May 17-21
- American Petroleum Institute, Mid-Year Meeting, Colorado Springs, Colo. .... June 1-3
- Second World Petroleum Congress, Paris, France ..... late May—early June
- Automotive Engine Rebuilders Association, 15th Annual Convention, Chicago ..... June 21-24
- American Society for Testing Materials, 40th Annual Meeting, New York, June 28-July 2

### CONTESTS

- Indianapolis Speedway, 500-Mile International Sweepstakes ..... May 31
- Pan American Cup Race, Roosevelt Raceway ..... July 5
- Roosevelt Raceway, 400-Mile George Vanderbilt Cup Sweepstakes ..... Sept. 6
- Los Angeles, 500-Mile International Sweepstakes ..... Nov. 28



# Just Among Ourselves

## Issues Need Clarification

**C**ONSIDERABLE discussion has been given recently to the possibility of adding two or three posts to the President's cabinet. Before the matter goes too far, we should like to present a suggestion that among the posts to be created should be that of an official Clarifier of Issues.

Like sick wine, the General Motors strike has floating in its depths some by-products of ferment which prevent one seeing the true nature of the substance in its essential clarity.

In arranging a conference this week between Mr. Knudsen, for General Motors, and Mr. John Lewis for the C.I.O., Governor Murphy let it be known that the request for the conference emanated from the White House.

In complying with the request, Mr. Knudsen issued a formal statement which contained the following words:

"The wish of the President of the United States leaves no alternative except compliance, and therefore we accede to your request."

Couple this point of view with General Motors' careful compliance with the law in its operations during the strike; its attempts to avoid bloodshed, even in the pursuance of its undeniable civil rights.

## Contrasted Policies

**C**ONTRAST this for a moment with the point of view of some of the union groups sitting down in the plants. In the

face of an injunction issued after a change of venue placed the unions in a better position to defend their cause, sitdowners telegraphed to Governor Murphy their defiance to attempts to move them from the plants.

Presumably depending on the law of the land for protection of their rights, whatever they may be, the strikers put themselves in the position of flouting that same law.

Some of our professional liberals have shed tears over the strikers being deprived of their civil rights. So far as we can see, some of the striking elements wouldn't recognize a civil right if they fell over it.

The essence of civil rights is an implied compact between citizens on one hand and the state on the other; in return for the guarantee of certain privileges to the citizen, the individual agrees to respect similar rights of other citizens with the state as arbiter-enforcer.

## There Are Two In an Agreement

**S**UCH contracts cannot exist on a one-sided basis. The obligation of the citizen is equally important with the obligation of the state, and this is a contention, which in any form of society except anarchy, must be preserved.

For more than 30 days there has been pending a decision on fundamental property rights, which except for the number of people involved, and the emotional complications present, could have been adjudicated clearly in 30 minutes. As this

is written, it is not entirely clear how constituted authority in Michigan will proceed with the enforcement of a court order for ousting strikers from G.M. plants in Flint, and adding to an existing law, a judicial fiat prohibiting picketing by strikers.

In the middle of January, Representative Maury Maverick introduced in Congress a bill "to preserve inviolate the rights of inhabitants of the United States and of other individuals under its protection, to provide punishment for the deprivation of such rights, and for other purposes."

Mr. Maverick's intention is laudable, except insofar as it fails to give a thought to the rights of corporate persons.

## A Bill to Establish Property Rights

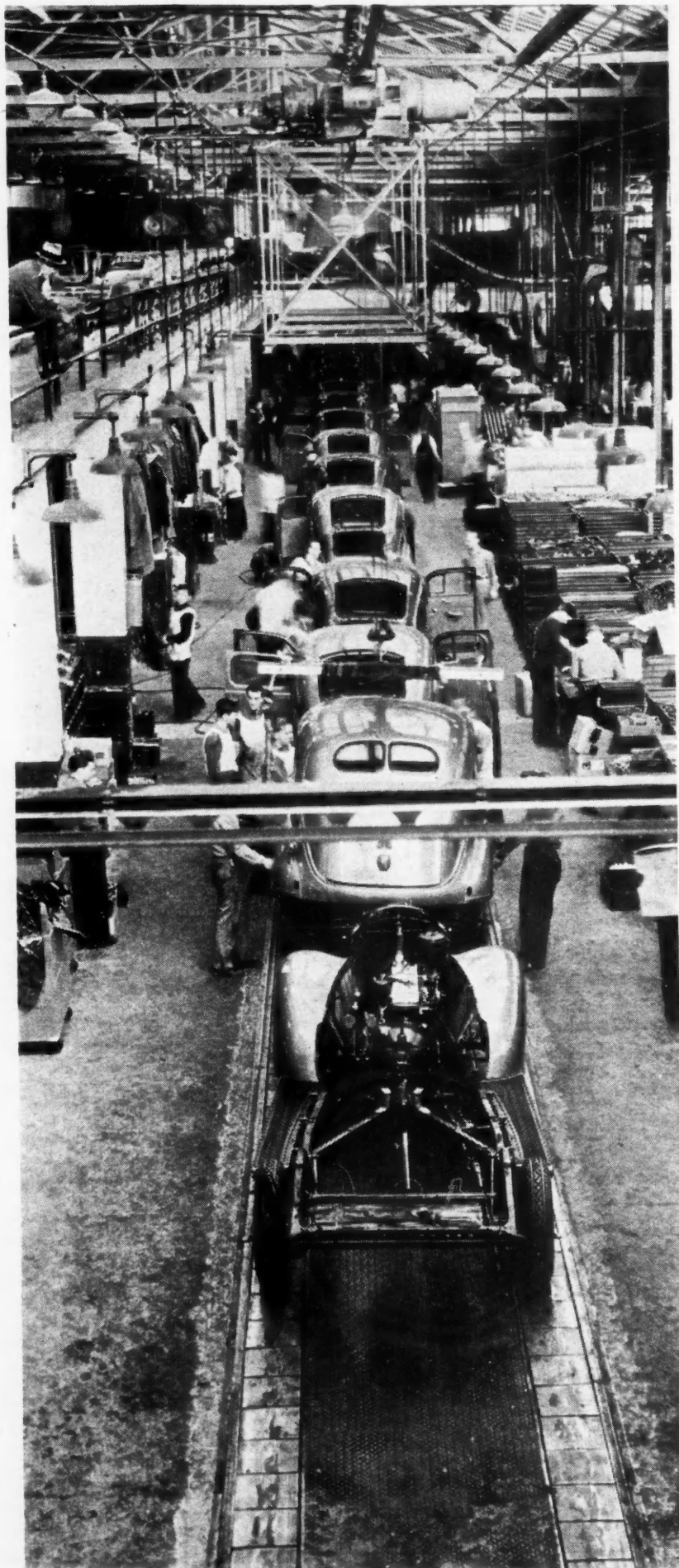
**T**HEORETICALLY, if the bill is passed, a stockholder of General Motors could sue any number of union members for deprivation of his property rights, the suit to be conducted as between natural persons on both sides. But, as we've pointed out before, the unions as a whole are not responsible for damage incurred in the course of strikes.

Let Mr. Maverick do something to make that position less one-sided and he will find additional favor for his "Civil Rights Enforcement Act."

It is somewhat confusing to remember that we have learned from childhood that the Constitution of the United States, in its first five amendments, is our guarantee of civil liberties. Later we find that to enforce these liberties a whole bundle of Federal statutes are necessary. And now we find that statutes are necessary to enforce the statutes. We expect to see any day now a bill to enforce the civil rights enforcement bill.

Meanwhile the "wish" of the President of the United States goes farther than a bundle of statute books. Think that over.

—H. H.



February 6, 1937

## THIS IS THE TENTH IN THE SERIES OF MONTHLY PRO- DUCTION FEATURES

**B**ORN in 1928, and steadily outgrowing its former quarters, De Soto has recently moved into a brand new plant. In 1937 the smart new De Soto with its mechanical advancement and fresh styling is the product of a new environment—the new home on a 40-acre tract at Wyoming and McGraw in Detroit.

This plant, with its modern production layout, up-to-the-minute equipment and materials handling devices, and worker-comfort features, was built under the watchful eye of Herman L. Weckler, vice-president and general manager, and continues under his direction.

Generally speaking, the De Soto plant comprises two independent buildings on the property. The main building is the assembly plant division, containing some 452,000 sq. ft. of floor space, the structure being part two-story and part three-story. This unit houses the administrative offices; a complete paint shop; and complete facilities for sub-assembly, chassis assembly, final assembly, and final inspection for shipment. The building is 1260 ft. in length.

The second unit is the press shop, which is housed in a new building of ultra-modern design with a high-vaulted roof, providing ideal daylight illumination and the maximum of breathing space. So far as daylight is concerned, the situation may be gaged from the fact that window glass, comprising some 30,000 panes, constitutes no less than 52 per cent of the total wall and roof area. Floor space in this building amounts to about 200,000 sq. ft.

The motor line for building the new high-compression six-cylinder engine, standard on De Soto for 1937, is located at the East Jefferson plant, which has been tooled up to provide the most mod-

Perspective of final assembly line with body drop and scheduling station at the left in the foreground

*Automotive Industries*



# The New DeSoto Plant —

*Apace with the latest developments  
in arrangement, equipment and  
worker-comforts*

By Joseph Geschelin

ern facilities. Apart from the layout of the motor lines, the plant is characterized by many items of new production equipment so unique as to be the first of its kind. In this category are the two huge horizontal Cincinnati broaching machines—decidedly the first of their kind—which will be described later; also the battery of towering Natco drillers and tappers—the largest of their kind to be used in a motor plant.

Considerable effort has been expended to assure worker-comfort along lines pioneered by Chrysler Corp. One detail

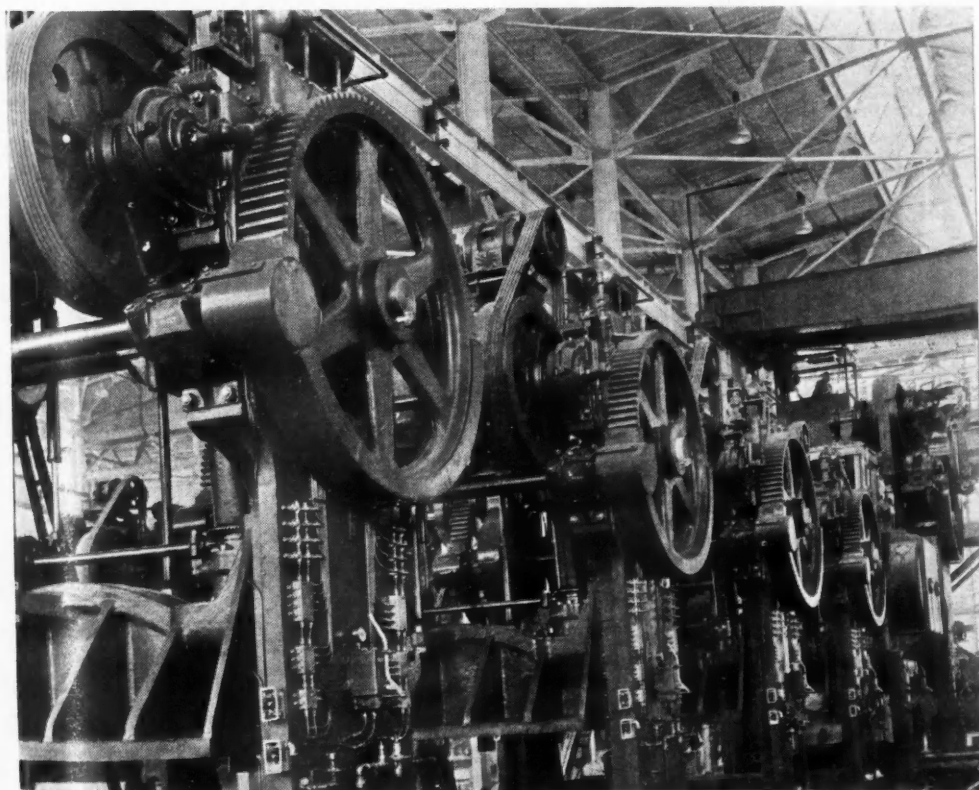
is daylight. As mentioned above, the new press shop gives the maximum benefit by a generous use of window glass. In the assembly plant this has been achieved by locating the two major assembly lines directly under the vaulted skylight section of the roof, the entire plant arrangement being built around this objective. For artificial illumination, all working stations in both buildings feature a complete system of the new high-intensity

mercury vapor lamps developed by G.E. Positively ventilated, water-type spray booths are used throughout so as to make it possible for operators to work in a clean, fresh atmosphere without the need for cumbersome protective devices and attachments.

All the usual back-breaking effort associated with materials handling has been eliminated by a complete system of feeder line conveyors in every department; and through the installation of crane-ways in the die shop and in press shop bays. In all, De Soto boasts over 2½ miles of conveyors.

Following modern practice in the industry, the scheduling of work in all fabrication departments and paint shop is linked to the final assembly lines by a comprehensive teletype installation.

With this brief com-



One of the press lines in the DeSoto press shop. The built-in automatic lubrication system is plainly seen on the side frame of each machine



ment on the high spots of one of the few really new plants to make an appearance in recent years, we are prepared to make a more detailed study of the plant as a whole and thus provide a clear perspective. In the following pages we shall give some attention to the layout, flow of materials, nature of the production process, and many details of equipment and specific steps in manufacture. We have also included a pictorial section featuring a large group of interesting photographs so as to aid in the visualization of the overall picture.

### Assembly Division

Here the entire first or street level floor has been laid out for car assembly. As mentioned earlier, the two principal assembly lines are located directly under the bright skylight section of the building, thus determining the general layout of the entire department. All materials and units come in at one end and feed to the assembly lines. At this end, we find unit assembly lines of preparatory nature such as—rear axle assembly, knee-action assembly, spring cover assembly, and initial frame assembly.

From this point on, the flow of work is directed to the chassis assembly line. As is customary, sub-assembly stations and feeder lines for principal units, such as the power plant, are located at the side of and at right angle to the conveyor line. When the chassis line reaches its terminal end, the chassis is lifted by a hoist running on an overhead craneway and is transported to the second parallel assembly line—the final assembly.

The final assembly line is located directly at the edge of the second floor gallery. Here the bodies are prepared on the hardware line and then are lowered

1—Rear axle assembly line serves as feeder to the chassis line which starts at the extreme right. Note the use of Thor balancers for all portable tools. Brake shoe adjustment fixture may be seen in use at two stations in the foreground

2—Two lines of presses are fed by the McKay roller-levelling machine shown at the side. This view shows the two gravity roller conveyors that carry the sheets. Blanks feed from a large distributing table, obscured in this view, fitted with bearing balls and arranged by tilting to feed one or the other of the conveyors

3—Front view of McKay levelling machine that feeds the two lines





This Aetna-Standard roller leveling machine is one of a battery of three levelers used in the DeSoto press shop

by means of a special body drop operating on an extended craneway.

An interesting detail on all assembly lines and assembly stations is the use of Hicycle portable tools suspended on Thor balancers which greatly facilitate handling. In addition, power to the portable tools from the motor-generator equipment is distributed through Bulldog power ducts which aid in producing an efficient and clean distribution system free of the usual complexity of loose dangling wires and connections.

A novel feature of the final assembly line is found in the fitting of the steering wheel. To assure an invariable alignment of steering wheel spokes, the wheel is left off the column until a given point on the final line is reached. Here the car is moved over a station equipped with two parallel rails which guide the front wheels parallel to the axis of the car. At this point the wheel is attached.

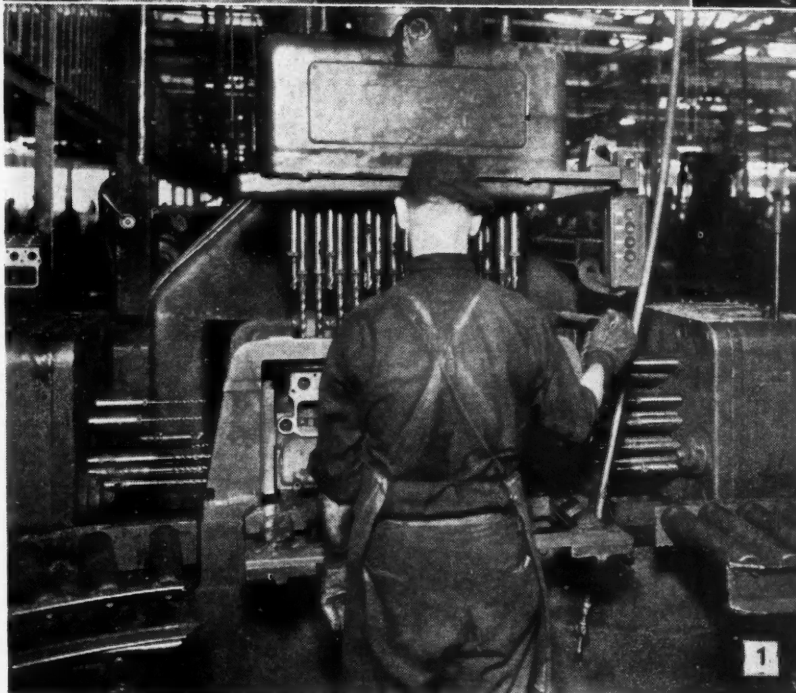
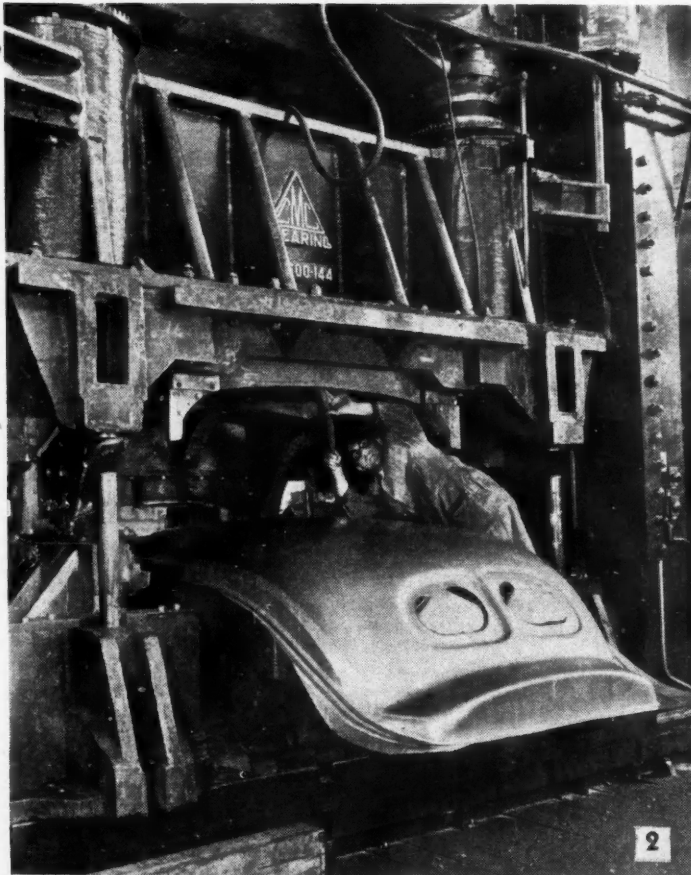
Another feature of the final line is the great length of pits providing a comfortable working position for the operators. The pit extends practically a major length of the entire line but is covered by steel plates at sections where it is not needed at the moment.

Flowmeters are used on the final line for accurate metering of gas and water.

Coming to the second floor, we find it divided into two sections—one side and the center portion of the floor space are devoted to body storage and the hardware line; the other wall bounds the small parts, paint, with spray booths and ovens, tire and wheel assembly, storage, and two long metal finishing bays. An interesting feature of the layout in the departments on this floor is

## Factory Routing for Connecting Rod

OPERATION	EQUIPMENT
Inspect forging	Bench
Broach sides of crank bore (1) rod and (1) cap to each ram	8½-48 in. Cincinnati double ram vertical hydraulic broach
Weigh and sort in groups	No. 451 Exact Weight scale
Broach joint face and half bearing (1) rod L.H. ram (1) cap R.H. ram	No. 10 - 54 Cincinnati double ram vertical hydraulic broach
(1) rod and (1) cap to each ram	SB-54-20 American double ram vertical hydraulic broach
	No. 9226 Toledo scale-bench
	No. 9282 Toledo scale-bench
Drill wrist pin hole	8-spindle Davis Rotomatic drilling machine
Chamfer both sides wrist pin hole	No. 56 Sundstrand double end drilling machine
Rough ream wrist pin hole	No. 3-B-1 Edlund drill press power feed
Broach sides and top of bolt bosses (1) rod and (1) cap to each ram	SB-42-6 American double ram vertical hydraulic broach
Wash	Tank
Grind joint face (rods and cap)	Wire basket
Drill bolt holes in rods and caps	20 in. Gardner semi-automatic grinder
(a) Load 2 rods and 2 caps	30-HO Baker hydraulic drill press
(b) Drill 2 rods and 2 caps ½ way	
(c) Drill 2 rods and 2 caps ¾ through	
Drill oil hole, mill anchor slots and chamfer bolt holes	Snyder special 5 station machine
(a) Load (2) rods and (2) caps	
(b) Drill (11) 3/16 in. holes	
(c) Drill 1/16 in. hole	
(d) Countersink bolt holes in rod and cap	
(e) Mill anchor slots in rod and cap	
Chamfer bolt holes (head end) and burr 1/16 in. oil hole	2-B-2 Edlund drill press
Ream bolt holes and burr joint face	2-B-1 Edlund drill press-power feed



1 — Three-way Greenlee drilling machine chamfers and drills 63 holes at one time

2—Another steel top operation at Briggs being handled on one of the huge Clearing presses

3 — Fairbanks springless scale is used for automatically weighing sheet steel bundles. It is fitted with an electronic mechanism which brings the scale beam to balance and prints ticket giving the exact weight

### De Soto Plant Conveyor Lines

Description	Length (Ft.)	Description	Length (Ft.)
Final inspection conveyor	300	Body hardware conveyor	890
Final assembly conveyor	400	Front fender slat conveyor	300
Chassis assembly conveyor	540	Rear fender slat conveyor	230
Rear axle assembly conveyor	40	Bonderite conveyor	1265
Frame assembly conveyor	60	Tire and wheel delivery	590
Truck assembly conveyor	200	Tire and wheel receiving	590
Motor storage conveyor	350	Wheel paint conveyor	390
		Small parts conveyor	430

Description	Length (Ft.)
No. 1 spray conveyor	400
No. 2 spray conveyor	410
Sheet metal distribution	1224
Prime oven	800
Lacquer oven	800
Wet sand & polish (sheet metal)	280

### PRESS PLANT

Sheet metal washer conveyor	1300
Shipping conveyor	600
Hood s'at conveyor	230
Hood slat conveyor	230
(2) Hood slat conveyor to be installed	



the fine attention to the detail of the overhead feeder conveyor lines dipping and rising at various elevations so as to provide the most convenient working height at each individual station.

Considering the body department for a moment, we find that finish-painted and trimmed bodies are received from the outside and delivered to the large storage bay by means of electric hoists. From this point the bodies are scheduled to the hardware line by teletype and move around on a huge rectangular floor conveyor line for the final assembly operations—installation of hardware, fittings, wiring, special equipment, etc. As in the case of other assembly lines in this plant, parts storage and sub-assembly stations are located at the side of the line at points of use. In their course over this line, the bodies are mounted on bucks at right angles to the conveyor so as to conserve space and increase the number of stations that may be handled on a closed circuit.

On the metal finish lines, all grinding equipment communicates with a positive exhaust system for drawing off dust and other fine particles as an aid to worker comfort.

All ovens used in the plant are fired with natural gas. Lacquer for all spray booths is distributed from a central paint station which controls the supply of specification colors to every spray booth. The color lines are in circulation constantly, 24 hours a day, in the interest of absolute uniformity even as to the temperature of the paint.

Spray booths are ventilated by forced draft of clean, filtered air, and are of water back type. The overspray is carried away by the water sheets and conducted to a waste pipe which carries overspray from the booths to a still-pond where it is collected and salvaged.

The third floor contains facilities for painting the major sheet metal parts and includes in its layout—a large Spr-Bonderite installation, spray booths, ovens, a large A-type oven for lacquer drying, and a merry-go-round conveyor for fender and hood polish.

The outstanding feature of the layout is the arrangement of two lines of spray booths, each one fed with conditioned air from two separate air make-up stations. In the air make-up, air is drawn in from the outside through automatically cleaning filters and as the air enters the enclosure, still under the influence of the suction of a huge blower, it is heated by direct fired gas heaters. Then the preheated and filtered air is collected in a large duct and fed under pressure to its bank of spray booths.

The Bonderizing treatment for the sheet metal is handled in a special machine comprising cleaning, Bonderizing, and rinsing stations, occupying a space

some 120 ft. in length. After the parts leave the machine they are transported through a drying oven.

There are three cleaning stages preceding Bonderizing, followed by clear water and an acidified rinse. The Bonderize section contains 240 spraying nozzles and requires about one minute for treatment of the work. Tank capacity is 2450 gal. of solution which is circulated through the bank of nozzles at the rate of 400 gal. per minute.

A feature of the third floor facilities is the merry-go-round conveyor for polishing fenders, hoods and miscellaneous parts. This line, too, is fitted with Hicycle tools fed from an overhead electrical duct. The conveyor line contains

a repair canopy for the spray booths and also contains a drying oven, thus making it completely self-contained and self-sufficient.

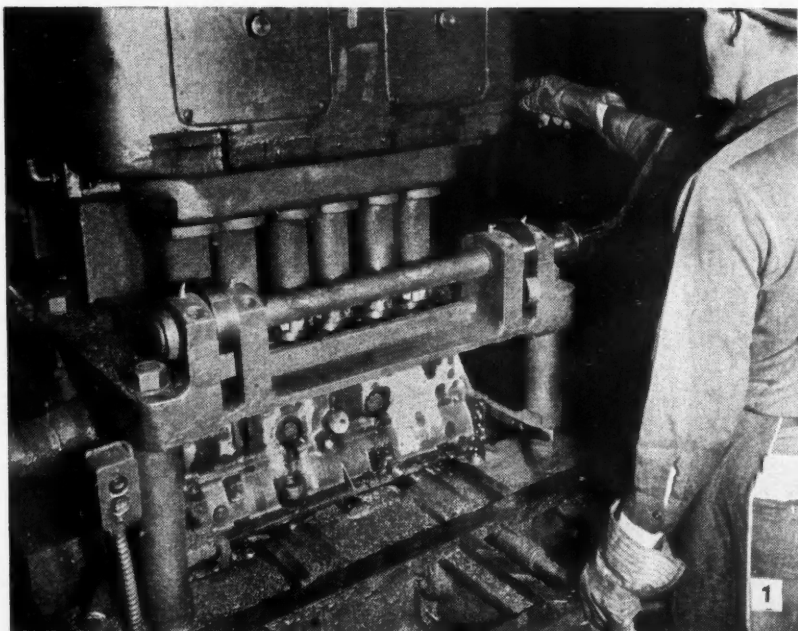
### Press Shop

The press shop is as modern as today. Its layout is based upon a consideration of the flow of material from ingoing sheets to outgoing finished stampings. Raw materials come in on a depressed spur track which runs the length of the building, the press lines being arranged in parallel rows at right angle to the receiving bay.

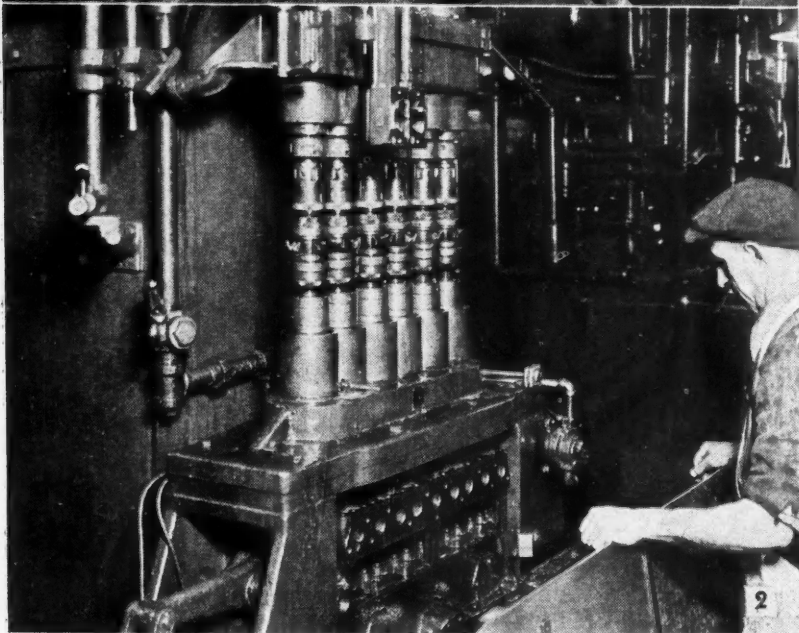
Each press bay as well as the well-equipped die shop is traversed by a heavy-duty crane for transporting mate-

## Connecting Rod Assembly

OPERATION	EQUIPMENT
Assemble and tighten	Bench
(1) Connecting rod	
(1) Connecting rod cap	
(2) Belts	
(2) Nuts tighten	Thor motor model HCM with No. 241 kickout attachment
Burr sides of bolt bosses	Emery wheel stand
Finish ream wrist pin hole	20 in. Barnes drill press
Ream crank hole	No. 210 Barnes drill press
Chamfer both sides of crank bore	No. 56 Sundstrand double end. machine
Grind both sides of crank bore	No. 16-A-2 Blanchard 2 spindle vertical rotary grinder
Grind crank bore for honing	No. 72 Heald Gagematic grinder
Burr one side of wrist pin hole and press in wrist pin bushing	Bench type burring fixture, 3-ton General Flexible power press
Chamfer both sides of wrist pin hole	No. 56 Sundstrand double end. machine
Mill oil slot in wrist pin end (4 parts at a time)	No. 1-12 Cincinnati plain automatic mill
Burr oil slot and burnish wrist pin bushing	6-ton General Flexible power press
Weigh crank end	No. 9516 Toledo scale
Machine crank end to weight	18 in. Cincinnati plain cam mill
	No. 1-12 Cincinnati plain automatic mill
Weigh wrist pin end	No. 9516 Toledo scale
Machine wrist pin end to weight, re-weigh and burr	No. 1-12 Cincinnati plain automatic mill
Burr crank and wrist pin end	Bench type polishing stand
Hone crank bore to size (4 parts a time)	No. 204 Barnes hydraulic hone machine
Wash	Tank
Diamond bore wrist pin hole	Coulter 4 spindle rotary vertical diamond bore
	Coulter single spindle diamond bore machine
Inspect	Bench



1 — Ingersoll boring machine is used to finish bore, six bores to 3.359 / 3.361 in.



2—Mirror finish honing on Barnes honing machine with six-spindle head fitted with Micromatic hones

rial and serving the presses. Press equipment represents the most modern makes and models available, including such makes as — Toledo, Hamilton, Clearing, Cleveland and Minster. All presses are fitted with built-in automatic Farval lubrication system.

The entire plant as well as each of the press bays is traversed by a system of overhead feeder conveyors, terminating at the shipping conveyor.

So far as worker comfort is concerned, De Soto has added a masterly touch which is well worth some comment. Good light and atmosphere already have been mentioned, but, in addition, they have built a gallery high off the working floor housing the showers, wash room, and lunch room. This gets the men off the floor and away from the shop environ-

ment for such as washing and eating.

Under the main floor is a huge open gallery which is the modern way of mounting presses. The presses no longer are set in pits but are rested upon steel girders which, in turn, are supported by massive concrete columns tied into the main floor foundation.

The press shop operates on a very flexible schedule which permits the fabrication of a wide variety of small and medium-sized stampings. Some of the products include—oil pans, hood tops, hood center panels, hood sides, radiator shells, miscellaneous braces and brackets.

A novel piece of equipment is the recent acquisition of a big sheet metal washing machine. This includes stations for alkaline wash and rinse, a drier,

and an oiling machine in a single unit.

Three roller leveling machines have been installed to prepare the sheets for the drawing operations. One of these is a new Aetna-Standard leveler; the others are new models of the well-known McKay levelers. A unique feature in connection with their installation is a wide distributing table fitted with large steel balls which is used for selective feeding of two gravity roller conveyors, one for each of two press lines.

Although space does not permit a detailed examination of the press set-up for some of the parts, we might mention in passing some features of the set-up for producing hood tops and sides. This includes two individual parallel lines of presses, several presses for each line. Most of the presses are fitted with several dies each so that different operations may be performed with each stroke of the press.

Finally it may be observed that this press shop is really a model of good housekeeping with an air of spaciousness and daylight and its evident comfortable working conditions.

### Motor Plant

Moving now to the motor line at the East Jefferson plant which builds the high-compression six-cylinder De Soto engine, we find one of the newest motor lines in the industry since it has been in operation only about five months at this writing.

Here is a very compact layout, literally straining the facilities of the present building. Following the best of modern practice, the machine shop lines have been arranged in parallel rows, all the work at each line having its beginning at one end of the building. Uniform and economical flow of materials is the basis for the whole scheme. Materials come in at one end, feed to the first operation of each line, and then move in unison to the forward end. The final stage, naturally, is the movement of finished parts to the motor assembly line, and thence to the chassis assembly.

Everything that goes into the engine is machined in the serried rows of equipment on the first floor of the motor shop. You can follow the course of the cylinder block, crankshaft, connecting rods, cylinder heads, camshaft, etc., by moving up and down the aisles.



Needless to say, it would take volumes to cover the details of what is done on even one of the machining lines and our chief concern has been to select just the high spots of some of the lines and thus present a general picture. This high-spotting, however, is accompanied by factory routings of the major parts so that it is possible to trace the course of each part step by step, noting the details of the equipment for each operation.

Before going much farther along this line, we think it is important to comment on the fact that this plant boasts some of the most interesting equipment to be found anywhere in the industry and, in fact, has some equipment that will be found nowhere else. Chief among the exclusive "firsts" are the two huge horizontal Cincinnati surface broaching machines which are to be described presently. Then, too, we find a battery of the towering Natco multiple-station drilling and tapping machines, the first examples of this type in the larger sizes.

The cylinder block has easily the lion's share of the new equipment. First we see the two Cincinnati broaches. One of these—a special horizontal Cincinnati Hydro-Broach—is used to finish from the rough in one pass of the broach, the manifold pad and valve chamber cover face. The machine weighs about 42,000 lb. and has a cutting speed of about 26 ft. per min. It completes the operation in 1.2 min. per block, producing 43 blocks per 52-minute hour.

The broaching ram is so designed that the faces of the cutting tools are in a vertical plane so that all chips and dust drop down into a chute.

The machine is arranged so that the conveyor line fits right into the operation. As the blocks come to the machine they are pushed into the fixture and located by two disappearing dowel pins which set them into position while the broach ram is being returned. As soon as the broach ram stops, the block is shifted toward the machine, quickly clamped in this position and properly stopped for the cut. Machine ram then makes one stroke to rough and finish the manifold side of the block. As soon as the last finishing blade of the tool passes over the block, the work is unclamped and withdrawn toward the operator so that the machine ram can be returned while unloading.

The second Hydro-Broach is used to rough and finish-broach bearing cap seats and simultaneously rough-broach crankshaft bearing bores. This machine weighs about 30,000 pounds and with a cutting speed of about 23 ft. per min. completes its operation in 0.70 of a minute, a productivity of

around 74 blocks per 52-minute hour.

The machine is supplied with an automatically operated fixture so that it is necessary only to push the block into the approximate position from a conveyor line, shift a lever to operate the automatic clamping fixture and

then start the broaching machine ram. The work is broached completely in one stroke of the broach ram, after which the work is raised again to the level of the conveyor and clamps are released. Operator can push the finished piece out of the fixture onto the

## Factory Routing Piston

OPERATION	EQUIPMENT
Inspect casting	Bench
Bore, face and chamfer open end, center head end	No. 4 Barden & Oliver turret lathe
Recenter open end	Bench and special centering machine
(2a) Load	12 x 21 in. Fay automatic lathe 8 x 21 in. Fay automatic lathe
(b) Rough cam turn O.D. and rough turn face head end	
(c) Rough turn ring grooves and finish turn lands	
(d) Finish cam, turn O.D. and finish face head end	
(e) Finish turn ring grooves and chamfer ring grooves	
Machine wrist pin hole	Krueger special 2-way horizontal machine
(a) Load 2 parts	
(b) Core drill and chamfer	
(c) Cut lock ring groove	
(d) Semi-finish ream	No. 121 Baker drill press special hydraulic feed
Core drill wrist-pin hole (2 at a time)	
Cut lock ring groove and chamfer wrist pin hole	
Drill (10) 1/4 in. holes in No. 3 groove (5) holes in No. 4 groove and (4) holes for saw slots	
Saw (1) horizontal and (2) vertical slots	Snyder special slitting machine
Weight, machine to weight and re-weight	Morris mill Toledo scale Morris mill Toledo scale
Burr horizontal and vertical slots and oil holes	Bench Thor high frequency motor
Recenter open end	Special centering machine
Cam grind O.D. and burr open end	10 x 18 in. Landis grinder 10 x 36 in. Landis grinder
Rough and finish diamond bore wrist pin hole (3 parts at a time)	No. 216 Ex-Cell-O diamond bore machine No. 49 Heald Borematic double end machine
Spotface head end to remove center boss	No. 3 Avey drill press No. 2 Avey drill press
Blow off and wash	Conveyor washer
Inspect before oxidizing	Bench
Repair when necessary	16 in. Reed lathe B-2018 11 in. x 4 in. Blount speed lathe
Grade and stamp	Martin marking machine
Load racks and place on conveyor for anodizing and wash	Bench, conveyor and 5 tanks
Wash	Tank
Inspect	Bench

## Factory Routing for

OPERATION	EQUIPMENT
Spray paint inspect	
Rough and finish mill bottom-rough and semi-finish mill top	Newton drum type mill V-4 Newton rotary mill
Drill and ream (2) locate holes—drill 29/64 in. deep oil hole part way	No. 114 D Moline 3-spindle drill
Countersink (2) locate holes	A E A Thor. hicycle motor on stand
Check casting for clearance for cam boring and tappet hole bushing plates	Special checking fixture
Straddle mill sides of main bearings	C-74 Newton rise and fall mill
Rough and semi-finish mill front and rear ends	Newton drum type mill
Core drill valve port holes	Putnam vertical hydraulic drill press
Rough bore cylinder to 3.255 in.—3.265 in.	Putnam vertical hydraulic boring machine with 6-spindle head
Broach manifold face	Cincinnati horizontal broaching machine
Broach bearing cap grooves and crank bearing half-circle	Cincinnati horizontal broaching machine
Mill generator bosses—mill distributor and distributor lock screw boss—mill clutch housing pan, bracket bosses—mill oil pressure relief valve boss	Newton special mill
Drill oil gallery hole from each end of block	Foot-Burt 2-way 4-block drilling machine
Drill top and water jacket side No. 1 station—Load (2) blocks	Natco center column driller 3-station (2 blocks in each station)
No. 2 station—top face-drill (12) valve stem guide holes	
Drill (3) 5/16 in. water holes (rear left-hand corner)	
Drill (4) 15/16 in. water holes	
Drill (6) 3/4 in. water holes	
Drill (2) 3/4 in. water holes	
Drill (4) 1/2 in. water holes	
No. 2 Position Horizontal Head	
Drill (4) 21/64 in. oil line holes 2 1/4 in. deep	
Drill (2) 7/16 in.—14 generator mounting screw holes	
Drill (2) 3/4 in. clutch housing pan bracket screw holes	
Drill 11/16 in. diameter and spotface oil pressure relief valve boss.	
Counterbore (2) lower welch plug holes	
No. 3 Position Vertical Head (top face)	
Drill 12 valve tappet holes	
Core drill oil filler hole	
Drill cylinder head stud holes	
No. 3 Position—Horizontal Head Water Jacket Side	
Core drill and counterbore (3) upper	
Welch plug holes	
Drill water jacket drain hole	
Combination drill 3/4 in. diameter and 31/64 in. diameter into oil pressure relief valve hole	
Countersink (2) 7/16 in.—14 generator mounting screw holes	
Countersink (2) 3/4 in.—16 clutch housing pan bracket screw holes	
Redrill (4) oil line holes through into cam bearings	
Counterbore underside of valve stem guide holes	
	66-D 6-spindle, Moline drill press

OPERATION	EQUIPMENT
Rough line ream (12) valve stem guide and tappet holes	Putnam vertical hydraulic drill press with (12) spindle head
Semi-finish line ream (12) valve stem guide and tappet holes	Putnam vertical hydraulic drill press with (12) spindle head
Semi-finish bore cylinders to 3.320-3.324 in.	Fitchburg boring machine
Mill crankshaft main bearing anchor slots	Putnam vertical hydraulic driller with special milling head
Drill all holes in bottom and manifold side also oil holes in tappet bosses No. 1 station load one block	Natco center column driller (6-station) (1 block in each station)
No. 2 station vertical head drill (2) "F" for 5/16 in.—18 holes (oil pan holes)	
Drill (3) letter "R" (0.257 in.) holes for 5/16 in.—18 tap (oil pan holes)	
Drill (4) 27/64 in. holes for 1/2 in.—13 tap (main bearing stud holes)	
Drill (2) 5/16 in. oil holes half way	
Drill (1) 29/64 in. hole for 1/4 in. pipe tap half way	
Drill (1) 19/32 in. hole for 3/4 in. pipe tap half way	
Drill (1) 29/64 in. hole for 1/4 in. pipe hole half way	
Drill (1) 1/4 in. hole into oil pressure relief valve	
No. 2 Station—Horizontal Head	
Drill (4) "F" (0.257 in.) tappet cover stud holes	
Drill (1) "F" (0.257 in.) breather pipe screw hole	
Drill (2) 1/2 in. holes into oil pump boss half way	
Drill (12) manifold stud holes	
Drill (1) manifold stud hole	
Drill (2) clutch housing pan bracket screw holes	
Drill (2) fuel pump holes	
No. 3 Position—Vertical Head	
Holes in bottom drill (1) 1/4 in. hole from bottom of block to oil pressure relief valve hole	
Drill (2) 13/64 in. holes for 1/4 in.—20 tap	
Drill (10) "F" (0.257 in.) holes for 5/16 in.—18 tap (oil pan holes)	
Drill (4) 27/64 in. holes for 1/2 in.—13 tap (main bearing stud holes)	
Drill (2) 5/16 in. oil holes half way	
No. 3 Station—Horizontal Head	
Manifold side—core drill manifold port holes	
Drill (2) 1/2 in. holes through in oil pump boss	
Core drill crankcase breather pipe hole	
No. 4 Position—Vertical head Bottom Holes	
Drill (2) 29/64 in. holes for 1/4 in. pipe tap to depth	
(1) in oil pump boss	
(1) for oil pipe in No. 3 bearing	
Drill (1) 19/32 in. hole for 3/4 in. pipe tap	
Drill (2) 5/16 in. oil holes to depth in Nos. 1 and 3 main bearings	
Countersink (10) 5/16 in.—18 holes	
Counterbore (4) 1/2 in.—13 main bearing stud holes	



## Cylinder Block

### OPERATION

No. 4 Position—Horizontal Head—Manifold Side  
Countersink (13) manifold stud holes  
Countersink (2) clutch housing pan bracket holes  
Countersink (4) tappet cover stud holes  
Countersink (2) 5/16 in.—18 fuel pump holes  
Countersink (1) 5/16 in.—18 crankcase breather pipe screw hole

No. 5 Position—Vertical Head Bottom Holes

Drill (2) 5/16 in. oil holes to depth in No. 2 and 4 main bearings  
Countersink (1) 1/4 in.—20 oil pan hole  
Countersink (10) 5/16 in.—18 oil pan holes  
Countersink (4) 1/2 in.—13 main bearing stud holes  
Finish drill (2) 5/16 in. oil holes

No. 5 Position—Horizontal Head—Manifold Side  
Drill angle oil holes in tappet bosses

No. 6 Position—Vertical Head  
Countersink (12) valve tappet holes  
Chamfer stud holes on top—chamfer top of tappet holes

Drill both ends

Vertical Head

Chamfer (21) cylinder head stud holes  
Chamfer top of (12) valve tappet holes

Horizontal Head—Front End  
Drill (3) 3/8 in.—16 water pump holes

Drill (10) 5/16 in.—18 cover holes

Drill (2) 5/16 in.—18 crankshaft thrust plate holes

Drill (1) 1/4 in.—20 oil tube slip hole

Drill (2) dowel holes

Horizontal Head—Rear End

Drill (2) 3/8 in.—16 holes

Drill (13) 1/4 in.—20 rear bearing oil seal holes

Drill (2) 27/64 in. holes

Drill (2) 31/64 in. holes

Drill (2) dowel holes

Counterbore oil gallery hole

Finish line ream valve stem guide and tappet holes (1 at a time)

Burnish tappet holes (1 at a time)

Inspect tappet holes 100%—day work

Rough counterbore for steel—insert and semi-finish intake throat diameter and countersink both ends

Vertical Head

Rough counterbore for steel—insert and semi-finish intake throat diameter and ream oil filler hole

Front End

Countersink (3) 3/8 in.—16 holes for water pump

Countersink (12) 5/16 in.—18 holes

### EQUIPMENT

Greenlee 3-way drilling machine

No. 3 Avey 1-spindle drill press  
No. 3 Avey gooseneck

No. 3 Avey gooseneck mounted on special base  
No. 3 Avey drill press gooseneck mounted on special base.  
Conveyor

Greenlee 2-way drilling machine for countersinking  
Putnam column mounted in back for counterboring

### OPERATION

Drill and countersink (1) 5/16 in.—18 hole near L. H. dowel hole  
Countersink (1) 1/4 in.—30 hole

Rear End

Countersink (2) 3/8 in.—16 holes

Countersink (3) 1/4 in.—20 holes

Chamfer bottom of cylinder bores and drill angle oil hole into No. 1 cam bearing

Tap all holes in bottom and both sides and (5) holes in front

Bottom Face

(8) 1/2 in.—13 main bearing stud holes

(20) 5/16 in.—18 oil pan holes

(2) 1/4 in.—20 oil pan holes

(2) 1/4 in. pipe tap holes

(1) 1/2 in. pipe tap hole

Manifold Side

(13) 3/8 in.—16 manifold stud holes

(4) 5/16 in.—18 tappet cover stud holes

(1) 5/16 in. 18 vent pipe screw hole

(2) 5/16 in.—18 fuel pump screw holes

(2) 3/8 in.—16 clutch housing pan bracket screw holes

Water Jacket Side

(4) 1/8 in. pipe tap oil line holes

(1) 1/4 in. drain hole

(2) 3/8 in.—16 clutch housing pan bracket screw holes

(2) 7/16 in.—14 generator bracket holes

(1) 3/4 in.—16 oil pressure relief valve hole

(4) holes in front end

Front

(1) 3/8 in.—16 water pump hole

(2) Camshaft thrust plate holes

(1) 5/16 in.—18 hole below oil gallery line

(1) 5/16 in.—18 hole near bottom of block on left side of main bearing center

Tap all holes in top and both ends

Top Face

(21) 7/16 in.—14 cylinder head stud holes

(1) 1/2 in. pipe on top of relief valve hole

Front End

(2) 3/8 in.—16 water pump holes

(1) 1/4 in.—20 oil tube clip hole

(2) 5/16 in.—18 cover holes

(Note: (2) camshaft thrust plate holes (1) 3/8 in.—16 water pump hole and 5/16 in.—18 hole near gallery line tapped in bottom and side taper)

Tap (1) 3/8 in. pipe oil gallery hole

Rear End

Tap (1) 3/8 in. pipe oil gallery hole

(2) 3/8 in.—16 clutch housing screw holes

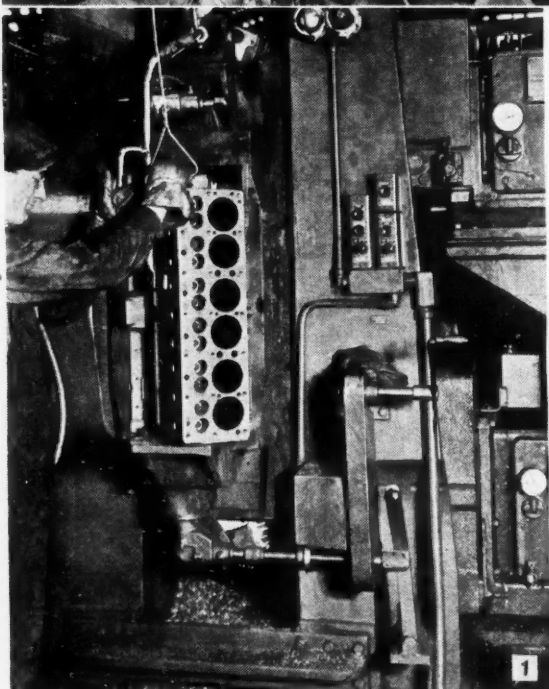
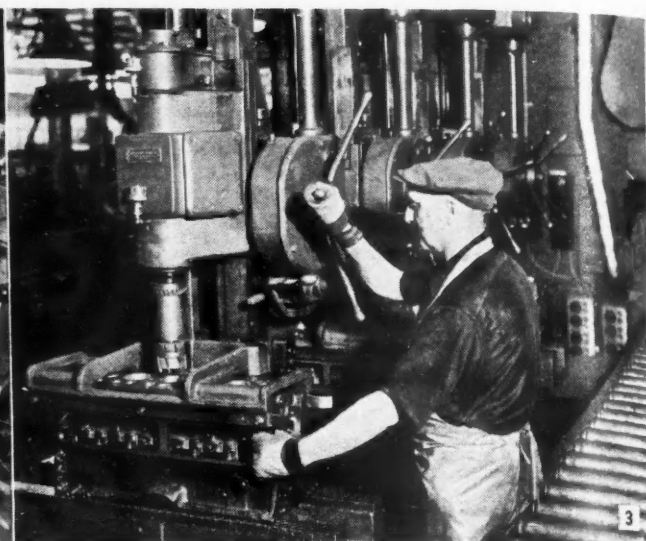
(3) 1/4 in.—20 rear bearing oil seal holes

### EQUIPMENT

No. 115 D Moline drill press with 6 spindles  
Bradford unit

Greenlee 3-way tapping machine

Greenlee 3-way tapping machine



1 — View of Natco two-way five-station boring machine for rough and semi-finish bore crank and cam holes; and counterbore Welch plug holes front and rear

2 — Horizontal Oil-gear machine used for assembly of cam bearing liners in 1, 2 and 3 cam bearing bores

3 — Cylinder bores are finish-reamed on this four-spindle Foote-Burt machine which also chamfers top of bores

conveyor while the machine ram returns to the starting point.

The arrangement of the machine is made so that it fits directly into the conveyor line, the machine being idle only during the loading time. Since loading takes place very quickly using an automatic type fixture, practically continuous production results.

In the background is a motor-driven dust exhaust system to remove dust and chips from the cutting tools during the broaching operation and keep the tools clean.

As the block routing indicates, there are four of the extraordinary Natco machines in service on the six-cylinder block. Two are drillers, handling practically every hole in the block; one is a combination driller and tapper; and one is a combination drilling and boring machine. Brief details of each

of the four machines are given below; the exact sequence of operation on each machine will be found on the routing.

The two drillers are station-type machines quite similar in appearance. Each has the following dimensions—height, 13 ft. 9 in.; length, 13 ft. 6 in. front to back; width, 20 ft. left to right. Weight of each machine is about 105,000 lb. The first of these is used for operations of top and water jacket side of the block. It is arranged with three stations, two working and one unloading and loading. Four Natco Holeunits (two mounted vertically and two mounted horizontally on the base) are arranged at each of the working stations.

The indexing of the table from station to station is accomplished by an automatic mechanical indexing mech-

anism and the entire machine is so interlocked that indexing will not function unless all heads, both vertical and horizontal, are in their correct positions. A shot bolt accurately locates the table after indexing.

Each Holeunit is arranged with a heavy duty spindle box. The four vertical boxes contain a total of 132 spindles, while the four horizontal boxes contain 48 spindles or a total of 180 spindles in all. All units in position No. 2 are driven by 10 hp. motors. The two horizontal units in position No. 3 are also driven by 10 hp. motors while the two vertical units in position No. 3 are driven by 15 hp. motors. The indexing mechanism for the table is driven by a 7½ hp. motor.

Six identical stationary type fixtures were furnished with the machine. Each is arranged to hold one cylinder block, the table indexing from station to station.

The second machine is being used for operations on the bottom and manifold side. It has six stations, five working and one unloading and loading. Nine Holeunits were used in building this machine. Five are mounted in a vertical position and four are mounted in a horizontal position. Each Holeunit is complete with a heavy duty spindle box.

The five vertical boxes contain a total of 88 spindles while the four horizontal boxes contain a total of 80 spindles. The vertical Holeunits in positions No. 2, No. 3, and No. 4 are each driven by a 10 hp. motor. Vertical units in positions No. 5 and No. 6 are each driven by a 7½ hp. motor. The horizontal units in positions No. 2 and No. 3 are driven by a 10 and 15 hp. motor respectively. The horizontal units in positions No. 4 and



No. 5 are each driven by a  $7\frac{1}{2}$  hp. motor. The indexing mechanism for the table is driven by a  $7\frac{1}{2}$  hp. motor.

Indexing of the table and interlocking of the machine are similar to that of the first machine.

Six identical stationary type fixtures were furnished with the machine. Each is arranged to hold one cylinder block, the table indexing from station to station.

The third machine is a two-way, six-head combination driller and tapper. It is built up of a large steel base, two bridge type auxiliary bases, six Natco Holeunits, and a five-position automatic mechanical indexing trunnion-type fixture arranged to hold one cylinder block in each position.

The three left-hand units are arranged with cluster boxes containing a total of 8 drilling and 2 tapping spindles. The drilling spindles are roller bearing mounted and are complete with nose adjustment. The tapping spindles are complete with individual lead screws, nuts and tap

holders. They are driven by an auxiliary reversing motor drive unit mounted on the top face of the Holeunit immediately behind the cluster box. The lower center unit is driven by a 10 hp. motor. The two upper units are each driven by a 3 hp. motor. The tapping unit is driven by a  $\frac{3}{4}$  hp. motor.

The three right-hand units are arranged with cluster boxes containing a total of 6 drilling and 1 tapping spindle. The lower center unit is driven by a 10 hp. motor. The two upper units are each driven by a 3 hp. motor. The tapping unit is driven by a  $\frac{3}{4}$  hp. motor.

Mounted in the center of the steel base is a five-position automatic indexing trunnion type fixture which is

arranged to hold one cylinder block in each position. The indexing mechanism is driven by a 3 hp. motor. The machine is so interlocked as to prevent the indexing of the fixture before the heads are in the correct position, also to prevent the heads from rapid traversing forward before the fixture is in its correct position. The operator has complete control of the machine through a single pushbutton station.

Finally we have the two-way, three-head combination drilling and boring machine which is used for boring the cam and crank holes; core-drilling and counterboring welch plug holes. This machine takes a floor space of 16 ft. 2 in. x 22 ft. and weighs about 68,000 lb.

1—Snyder special slitting machine for sawing one horizontal and two vertical slots in piston

2—Cam grinding piston O. D. and burring open end on battery of Landis grinders

3—One of a battery of Fay automatic lathes used for rough and finish cam-turning O. D.; rough and finish turning of head end and ring grooves



## Factory Routing Cylinder Block Assembly

OPERATION	EQUIPMENT	OPERATION	EQUIPMENT
Brush out valve stem guide holes and assemble (12) valve stem guide	25 Ton 2 column vertical oilgear press	Brush out loose paint in crankcase	Haskins polishing motor
Assemble (5) Welch plugs to side of block	MNL Thor chipping hammer	Mill oil pump pad and fuel pump pad—and fuel pump pad—mill clutch housing pan bracket bosses—locating from crank and cam bearings	Putnam special horizontal mill
Finish mill top of block	Type V-4 Newton rotary mill	Rough mill oil slinger groove and drill 3/16 in. angle oil hole into distributor boss	Cincinnati eccentric head mill with Leland-Gifford gooseneck for 3/16 in. angle hole
Drill and tap oil gage hole	No. 2 Avey 2 spindle drill press	Finish mill thrust bearing faces of No. 4 bearing (Note—machine equipped to drill 3/16 in. oil hole in distributor boss)	Cincinnati eccentric head mill with Leland-Gifford gooseneck for 3/16 in. angle hole
Rough ream valve stem guide holes (12 at a time)	No. 114 Moline hydraulic drill with 12 spindle head	Finish drill oil holes into Nos. 1-2-3-4 cam bearings for anchoring bearing liners and finish ream relief valve hole	Foot-Burt 1-way horizontal driller
Finish ream 0.342—0.343 in. valve stem guides (12 at a time)	No. 114 Moline hydraulic drill with 12 spindle head	Finish mill front end rear end of block locating from crank bearings	45-60 Cincinnati duplex hydromatic mill Fitchburg duplex mill
Finish counterbore for steel inserts	No. 114 Moline drill press	Machine oil pump and distributor hole	Natco 2-way drum type driller
Machine intake valve seat and finish intake throat diameter	Conveyor and Special assembly tool	Station No. 1—Load one block	
Blow out and assemble (6) 666012 exhaust inserts	Conveyor and special peening tool	Station No. 2—Distributor Side	
Peen metal around inserts	Ingersoll boring machine	Drill (1) 13/16—13/16 in. deep for 1/4 in.—20	
Finish bore cylinder bores to 3.359-3.361 in.	4-spind. Foote-Burt gang reamer	Drill dist. hole to 1 in. diameter 2 1/2 deep	
Finish ream cylinder bores and chamfer top of bores	Barnes honing machine with 6-spindle head	Station No. 2—Oil Pump Side	
Rough hone cylinder bores	Barnes honing machine with 6-spindle head	Drill (2) 5/16 in. hole for 3/4 in.—16 tap 1 1/4 in. deep	
Finish hone cylinder bores	Hutto 1 spindle honing machine	Drill (1) 13/16 in. hole for 1.155 in. ream	
Rehone cylinder bores when necessary	Conveyor and steel stamps	Station No. 3—Distributor Side	
Inspect and stamp bores	Special water test fixture	Counterbore and Spotface (1) Hole for 1/4—20 tap	
Water test	Metal parts washer	Drill 9/16 in. hole—Counterbore and chamfer distributor hole	
Wash block and blow off	Conveyor and steel stamps	Station No. 3—Oil Pump Side	
Stamp bearing caps and cylinder block for position identification	ADB Thor Bicycle motor	Countersink (2) 3/4 in.—16 holes	
Assemble main bearing cap studs	Conveyor	Redrill and Countersink oil pump hole	
Loose assemble to block	Conveyor—Size CC Ingersoll-Rand air motor	Station No. 4—Distributor Side	
Drive down main bearing cap nuts	Natco 2-way 5-station crank and cam bearing boring machine	Tap (1) 1/4 in.—20 hole and end cut ream distributor hole	
Core drill—rough and semi-finish, bore crank and cam holes—counterbore Welch plug holes in front and rear end		Oil Pump Side	
Station No. 1 Load 2 blocks		Tap (2) 3/4 in.—16 holes and end cut ream oil pump hole	
Station No. 2 Front end		Station No. 5—Distributor Side	
Counter drill No. 1 crank hole		Finish ream 1.0625-1.0635 in. hole	
Counter drill No. 1 cam bearing		Oil Pump Side	
Drill oil gallery hole part way from each side		Finish ream 1.155-1.1565 in. oil pump hole	
Station No. 2 Rear end		Finish bore crank and cam bearings—ream dowel holes in rear end	Greenlee special 4-way boring and reaming machine
Counter drill No. 4 crank and No. 2 2 11/16 in. diameter and chamfer No. 4 bearing		Insert pilots for grinding valve seats	Conveyor
Counter drill and finish counterbore No. 4 cam		Grind intake valve seats	Conveyor—No. OH Thor air motor
Counter drill and counterbore Welch plug hole		Grind exhaust valve seats	Conveyor—No. OH Thor air motor
Drill oil gallery hole through		Indicate seats and mark for regrinds	Conveyor
Core drill No. 2 and No. 3 cam bearing		Blow out and assembly (2) dowels to rear end of block	Conveyor
Core drill No. 2 crank bearing		Assembly cam bearing liners to Nos. 1-2 and 3 bearings	Oilgear horizontal machine
Drill oil gallery hole through			
Station No. 3 crank and cam boring Rear End			
Counter drill No. 3 crank bearing			
Station No. 4 Front End			
Rough bore crank bearings			
Rough bore cam bearings			
Station No. 5 Front End			
Semi-finish bore crank bearings			
Semi-finish bore cam bearings			



The two front heads are mounted on Natic Holeunits, each of which is driven by a 20 hp. motor. The right-hand box contains 12 roller bearing mounted spindles, and the left-hand head contains 10 roller bearing mounted spindles. All spindles in both boxes are arranged with nose adjustment.

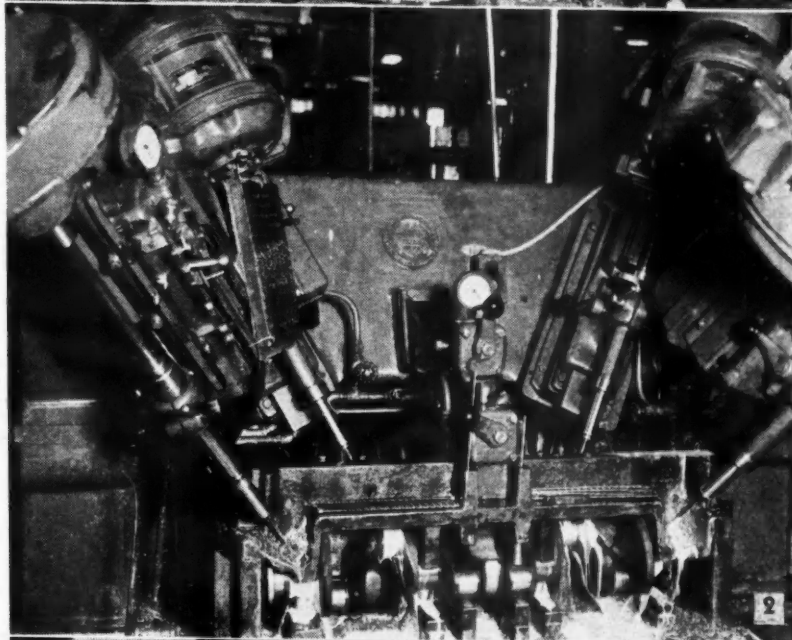
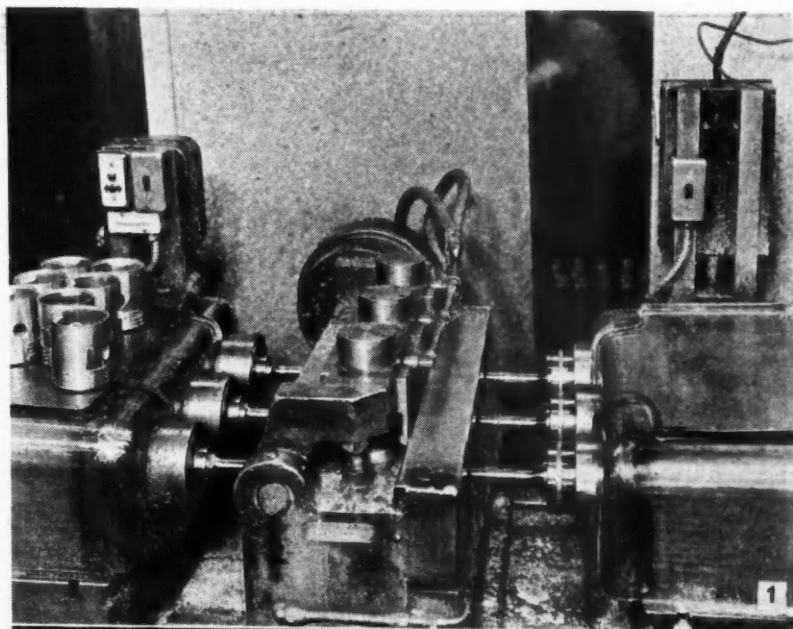
The rear right-hand head is mounted on a special heavy duty hydraulic unit with an extremely long stroke. The head is equipped with 8 roller bearing mounted spindles arranged for floating drive boring bars and equipped with outboard bearing supports. This head is driven by a 15 hp. motor.

The two Holeunits are mounted upon bases which, along with the other hydraulic unit, are mounted against and bolted to a large welded steel pedestal upon which is mounted a six position automatic conveyor type fixture arranged to hold two cylinder blocks in each position. The fixture is operated by hydraulic pressure and is interlocked electrically to the heads to insure that all blocks are in their correct positions before the heads begin their various operations.

While the heads are completing their cycles, the conveyor returns to the loading station after which the operator again loads two cylinder blocks. The operator completely controls the machine through the use of one push-button station.

The connecting rod line, as will be noted in the factory routing, is distinguished by a battery of surface broaching machines which are used exclusively in finishing the big end and the bearing caps. In addition there is the Davis Rotomatic drilling machine for drilling wrist pin holes.

The piston line is decidedly new and modern. In the line, as detailed by the routing, will be found all the equipment including a large automatic machine for anodizing. Here will be found—Fay automatic lathes, Baker



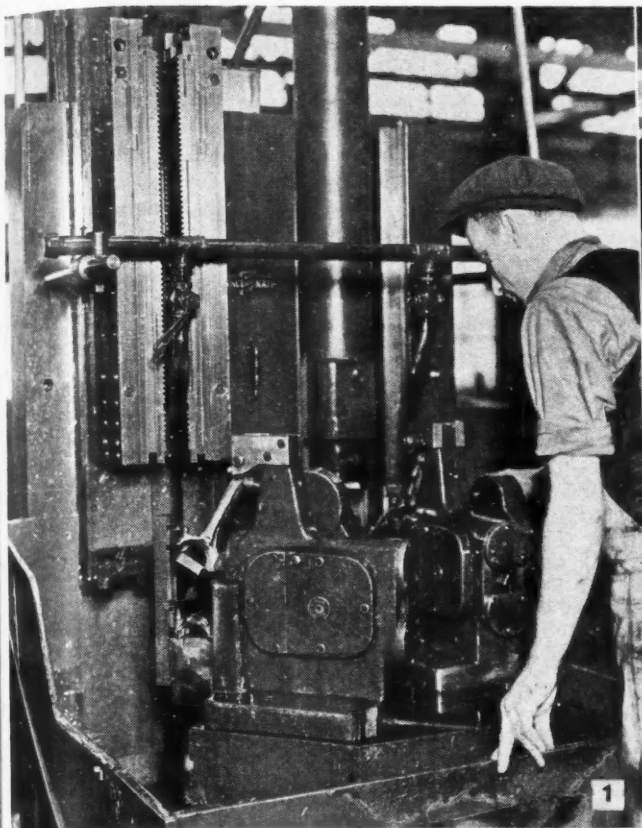
1—Ex-Cell-O precision boring machine is used to rough and finish-bore wrist pin hole, three pistons at a time. A No. 49 Heald Bore-matic double-end precision boring machine also is a part of the battery used for this purpose

2—Part of a battery of new Leland-Gifford sensitive drills with step-by-step feed mechanism for drilling crankshaft oil leads, automatically

3—Rear bearing of DeSoto crankshaft is finish-ground to width on this 10 x 36 Norton grinder

# Factory Routing of Crankshaft

OPERATION	EQUIPMENT	OPERATION	EQUIPMENT
Inspect forging	4-36 inch Cincinnati hydraulic mill	Rear end Drill 27/32 in. hole to depth	
Mill locating spots on No. 1 and 6 cheeks (2 cranks at once)	Fitchburg mill with 2 horizontal spindles	Station No. 4 Front end Counterbore and chamfer	
Rough machine ends and line bearings	7 A C LeBlond double center drive lathes 5 A C LeBlond double center drive lathes	Rear end Drill (4) Flange holes	
Straighten	20-ton general flex. power press	Station No. 5 Front end Counter drill thread dia.	
Finish machine ends and line bearings	LeBlond D.M. finish turning machine	Rear end Ream (4) Flange holes	
1st Station Load and unload		Station No. 6 Front end Tap	
2nd Station (a) face end of flange, undercut and chamfer O.D., (b) finish form oil slinger sides, (c) face sides of No. 4 main bearing and radius, (d) face sides of No. 3 main bearing and radius, (e) face sides of No. 2 main bearing and radius, (f) face side and radius of No. 1 main bearing, (g) chamfer face end of No. 1 bearing—Undercut, turn and chamfer front end		Rear end Rough bore and recenter rear end	
3rd Station (a) turn flange O.D.—turn oil slinger O.D. Face back of flange face No. 4 bearing (b) turn front end and No. 1 bearing		Straighten	20-ton general flex. power press
4th Station (a) turn oil slinger, turn No. 3 main bearing (b) turn No. 3 main bearing (c) turn No. 2 main bearing (d) turn No. 1 main bearing (e) face end		Finish grind all pins	16x42 in. type A Landis hydraulic grinder
Rough grind No. 1 and 2 line bearings	10x48 in. Landis hydraulic grinder	Inspect plane of pins	Bench
Rough grind No. 3 and 4 line bearings	10x48 in. Landis hydraulic grinder	Straighten	20-ton general flex. power press
Check pin side of counter weights	6 AC LeBlond 2 spindle cheeker	Finish bore and recenter pilot hole	16x8 in. Monarch lathe 16x8 in. Monarch lathe
Form all pins	6 AC LeBlond 2 spindle pin turning lathe	Inspect pilot hole	Bench
Straighten	20-ton general flex. power press	Burr oil holes—flange holes and file burrs on pins	Bench AKG Thor electric motor
Drill angle oil holes all at once	Leland-Gifford special 6 unit drilling machine	Finish grind gear fit and fan pulley diameter	10x48 in. Landis grinder 10x36 in. Landis hydraulic grinder
Finish grind No. 2 and 3 line bearings	10x48 in. Landis hydraulic grinder	Straighten	20-ton general flex. power press
Finish grind rear bearing to width	10x36 in. Norton grinder	Grind face of flange	10x36 in. Norton grinder 10x36 in. Norton hydraulic grinder
Finish grind rear bearing diameter	10x48 in. Landis grinder	Mill Woodruff keyway and straighten keyway	No. 3 Sundstrand Rigid-mill
Grind oil slinger groove diameter	10x36 in. Landis hydraulic grinder	Dynamic—balance	Tinius Olsen balancing machine
Finish grind O.D. of flange	10x36 in. Norton grinder	Drill into counterweights when necessary	20 in. Barnes drill press No. 2 Colburn drill press
Finish grind No. 1 bearing	10x36 in. Landis grinder	Finish dynamic balance	Tinius Olsen balancing machine
Drill and ream flange holes, etc.	10x48 in. Landis grinder 10x36 in. Landis grinder	Drill into No. 3 and 4 pin for balance when necessary	No. 121 Baker drill press
Station No. 1 Load 2 pieces		Drill into No. 1 and 5 and 2 and 6 pin for balance	No. 121 Baker drill press No. 121 Baker drill press No. 121 Baker drill press
Station No. 2 Front end Drill 1 1/32 in. dia. 1 3/16 in. deep		Straighten	20-ton general flex. power press
Rear end Drill 57/64 dia. part way		Check dynamic balance and drill when necessary	Tinius Olsen balancing machine Hammond radial drill press
Station No. 3 Front end Drill 25/32 in. hole		Re-check dynamic balance and drill for balance when necessary	Chrysler balancing machine
		Check static-balance when necessary	Micro-Poise balancer
		Polish side walls of No. 4 bearing	Polishing lathes
		Polish oil slinger and file burrs on front end No. 1 bearing—oil slinger and flange	16x6 in. Monarch lathe
		Hone and polish all pins and main bearings	Foster crankshaft honing machine
		Inspect diameter of pins—main bearings	Bench
		Wash	Power washer
		Place in checking fixture gage—check spacing of pins and main bearings—runout of main bearings—runout of O.D. and face of flange—runout of pilot hole—check keyways	Bench and special checking fixture

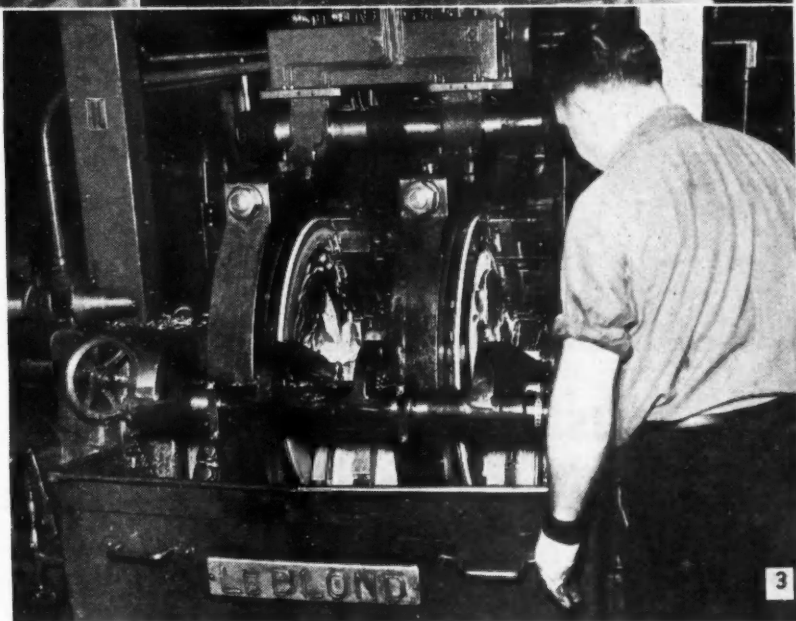


1—Cincinnati double ram vertical hydraulic broach is used to broach sides of connecting rod big end. The fixtures take one rod and one cap to each ram



2—Baker hydraulic drill press used to drill bolt holes in rods and caps. This is done in three steps—load two rods and two caps; drill half-way; drill halfway through

3—One of a battery of LeBlond double center drive crankshaft lathes



drill presses with special hydraulic feed, Ex-Cell-O and Heald boring machines, the latter being a double-end Borematic designed for the operation. A unique feature of the piston line is the Morris milling machine with Toledo scale attachment which is used for automatic balancing.

The crankshaft line has been provided with the latest types and sizes of the familiar LeBlond lathes, Norton and Landis grinders, a Greenlee six-station drilling and tapping machine, and various other items too numerous to detail. Dynamic balance is a very important element of the operation, entailing a number of separate checks as noted on the routing. All main bearings and pins are polished and lapped on a special Foster

honing machine.

It is of interest to note that the cylinder bores are given the double-honing mirror-finish on Barnes honing machines fitted with Micromatic hones.

Conveyors are used throughout to expedite the scheduled flow of materials to the lines, along the lines, and finally to the motor assembly. Overhead conveyors serve as feeder lines—gravity roller conveyors connect the operations from machine to machine.

Finally, the finished units, complete in every detail and block-tested, are transported to the assembly line at

the new De Soto plant and stored on the bank for immediate use.

### Summary

The foregoing is intended to give a quick but comprehensive perspective of one of the very latest automobile manufacturing plants. We hope that the brief highspotting, supplemented by official factory routings, and brightened by the pictorial section, will give readers of *AUTOMOTIVE INDUSTRIES* a good impression of the activity and philosophy of manufacturing that is characteristic of Chrysler Corp.



## NEW DEVELOPMENTS

### Arc Welders

#### Selective Motor Hp Control Feature of New Line

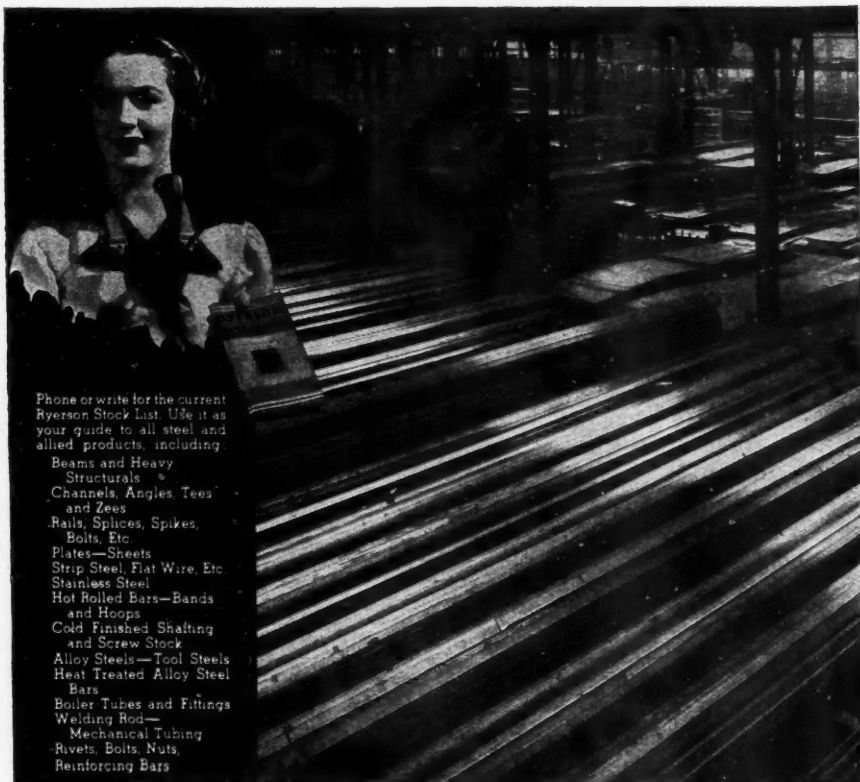
The Hobart Brothers Co., Troy, Ohio, recently announced its new line of current-saving arc welders which

embody what is termed "Selective Motor Hp Control."

Operation of the "Selective Motor Hp Control" is accomplished as follows: With the operating handle locked in the "low" position, only half the rated motor horsepower is used for starting and for welding up to  $\frac{1}{2}$  the rated generator capacity in continuous manual arc welding (up to  $\frac{2}{3}$  rated capacity for intermittent welding). For operation at higher rates, the handle

is turned to the "high" position where the full rated horsepower of the motor is available for full load and overload welding. It is possible, when so desired, to start and weld in the "high" position without turning the handle to the "low" setting at any time.

This new series MN includes units rated as follows: 75 amp.,  $\frac{1}{2}$  to 3 hp.; 100 amp.,  $2\frac{1}{2}$  to 5 hp.; 150 amp., 5 to 10 hp.; 200 amp.,  $7\frac{1}{2}$  to 15 hp.; 300 amp., 10 to 20 hp.; 400 amp.,  $12\frac{1}{2}$  to 25 hp.; and 600 amp., 20 to 40 hp.



Phone or write for the current Ryerson Stock List. Use it as your guide to all steel and allied products, including:

- Beams and Heavy Structural
- Channels, Angles, Tees and Zees
- Rails, Splices, Spikes, Bolts, Etc.
- Plates—Sheets
- Strip Steel, Flat Wire, Etc.
- Stainless Steel
- Hot Rolled Bars—Bands and Hoops
- Cold Finished Shifting and Screw Stock
- Alloy Steels—Tool Steels
- Heat Treated Alloy Steel Bars
- Boiler Tubes and Fittings
- Welding Rod—Mechanical Tubing
- Rivets, Bolts, Nuts, Reinforcing Bars

## Thousands of Tons of Steel in Stock for Immediate Shipment

**H**ERE is steel in every shape and size in standard and alloy grades—in stock for Immediate Shipment. Allied lines such as welding rod, babbitt, boiler tubes, and fittings are also carried. Shears, saws and special flame cutting equipment quickly cut to any length or

special shape. Whatever your requirements you can call on Ryerson with full assurance that everything possible will be done to deliver the material well within the time specified. Ten plants stand ready to serve you. Draw on the nearest one.

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cleveland, Detroit, Cincinnati, Buffalo, Boston, Philadelphia, Jersey City

# RYERSON

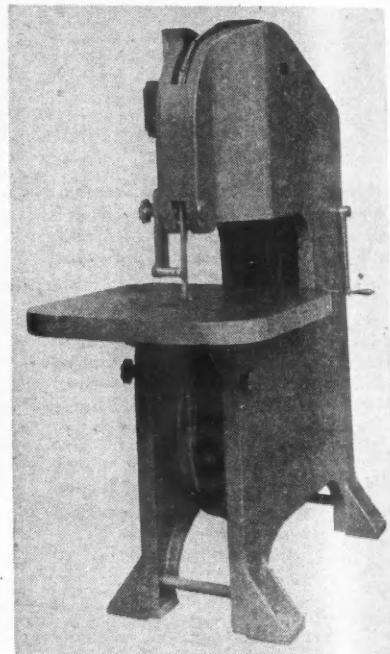
February 6, 1937

### Filing Machine

#### 24-in. Throat, Heavy-Duty Model Offered By Grob Brothers

A large throat (24 in.), heavy-duty, continuous-motion filing machine has been placed on the market by Grob Brothers, Grafton, Wis.

In order to eliminate slippage the chain to which the files are attached is



Grob filing machine

driven positively. Files are guided by a hardened file support, and the thickness of the files is said to be kept to an accuracy of 0.002 in. The machine is also arranged for chains of abrasive stones which are used to lap dies after they have been hardened.

Power from the  $\frac{1}{2}$ -hp. motor is transmitted by V-belt drive, and three speeds are provided.

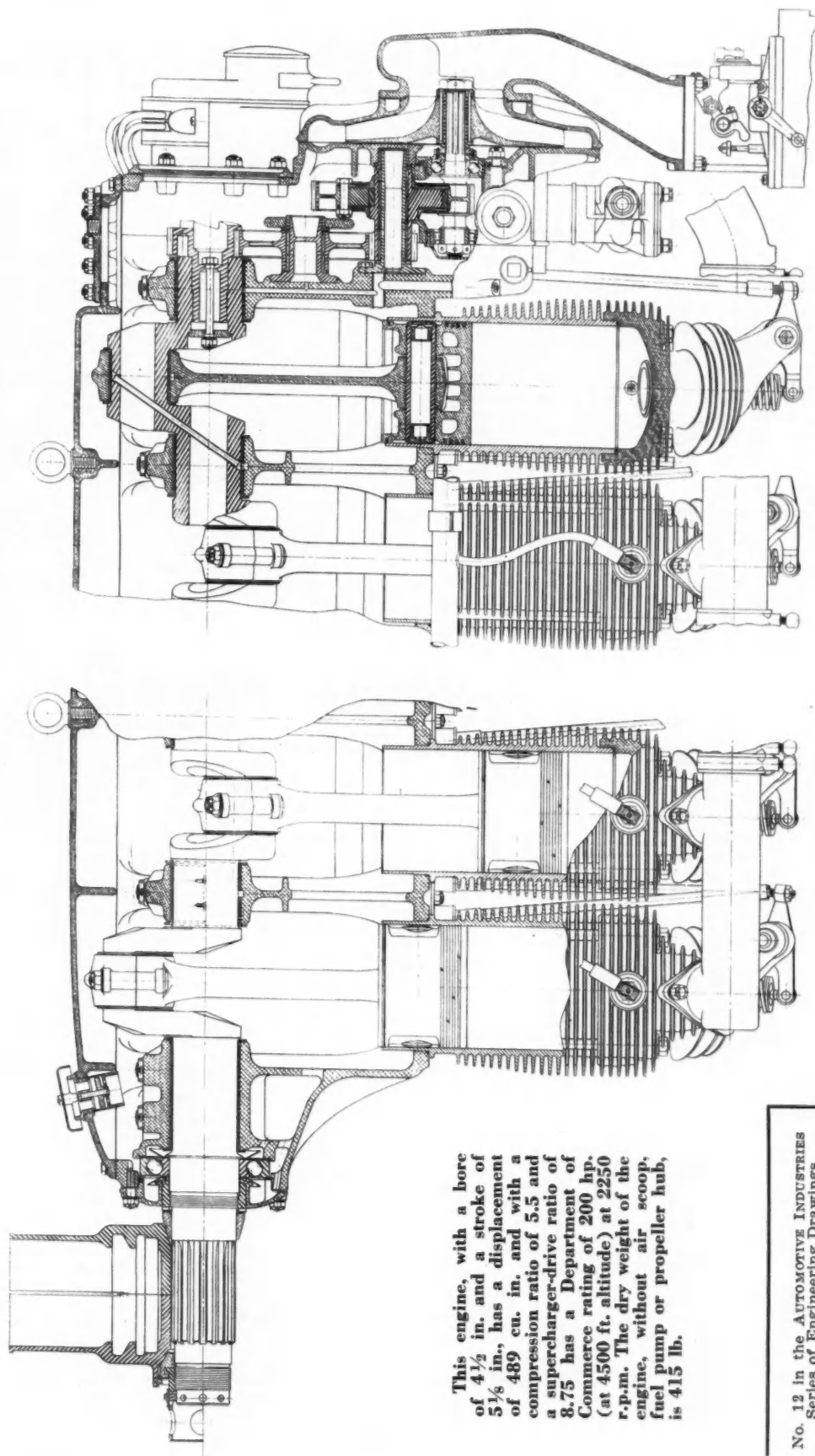
### Portable Grinders

#### New Electric Production Tools Added to Well-Known Line

The Chicago Pneumatic Tool Co. recently added two portable electric (Turn to page 203, please)

Automotive Industries

# Menasco Six-Cylinder Inverted Aircraft Engine

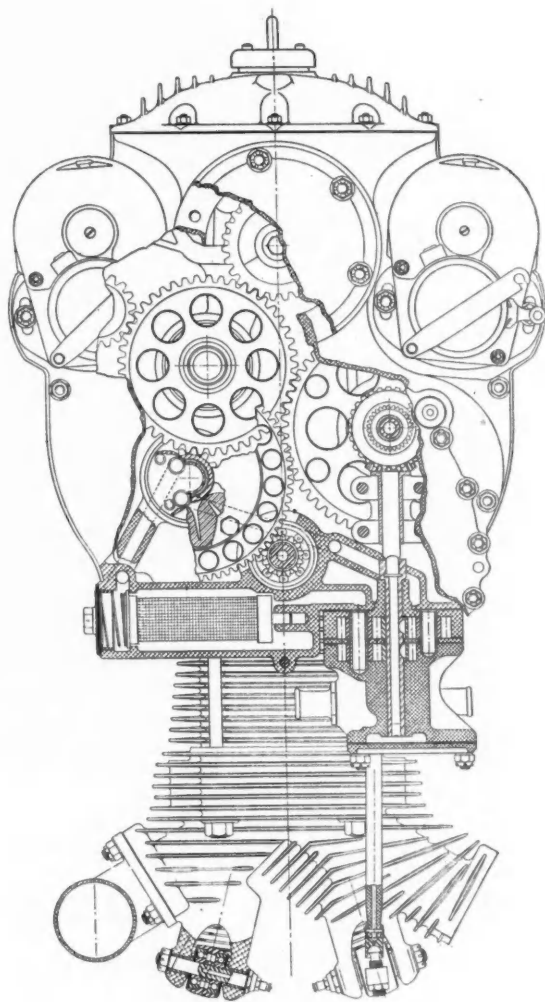
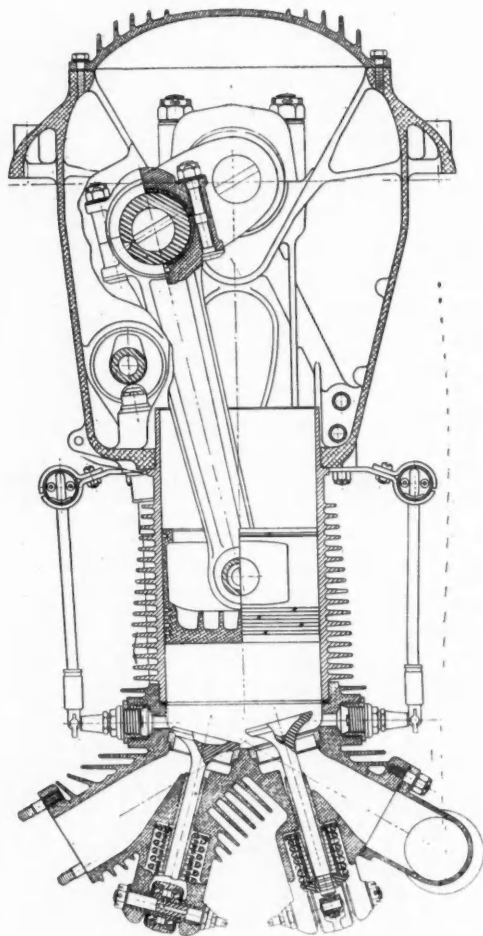


This engine, with a bore of  $4\frac{1}{2}$  in. and a stroke of  $5\frac{1}{8}$  in., has a displacement of 489 cu. in. and with a compression ratio of 5.5 and a supercharger-drive ratio of 8.75 has a Department of Commerce rating of 200 hp. (at 4500 ft. altitude) at 2250 r.p.m. The dry weight of the engine, without air scoop, fuel pump or propeller hub, is 415 lb.

No. 12 in the AUTOMOTIVE INDUSTRIES  
Series of Engineering Drawings

# Menasco Six-Cylinder Inverted Aircraft Engine

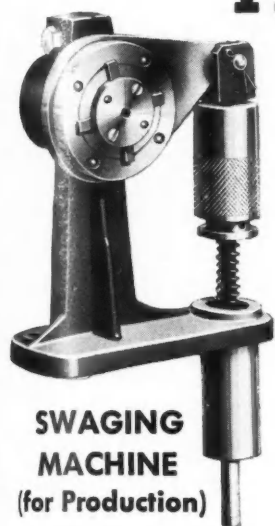
The crankcase cover is provided with ribs and is held down by a large number of studs. An engine mounting ledge is incorporated in the crankcase casting. There are two valves per cylinder, arranged at an angle in the cylinder head, and both seating on valve-seat inserts in the light-alloy head casting. The crankshaft, which is carried in seven main bearings, is provided with an S.A.E. No. 20 propeller end. A cushioned



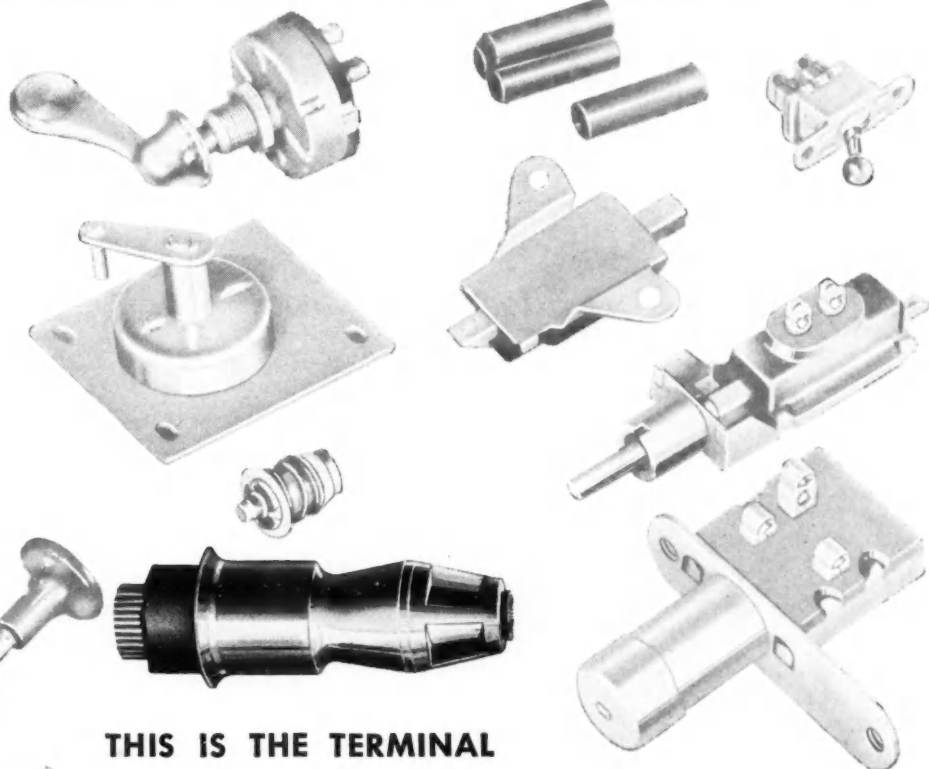
drive is provided for the impeller. There are two spark plugs in each cylinder and two magnetos are provided for ignition, one on each side of the engine. Note that the spark plugs are screwed into small chambers in the cylinder head that communicate with the combustion chamber through a throat. Gasoline of 80 octane number is recommended, and the consumption at rated output is given as 0.56 lb. per hp.-hr.



# Swaging Machine and Pliers —for PERMANENCY of TERMINAL CONNECTIONS!

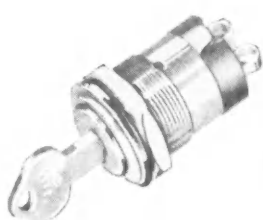
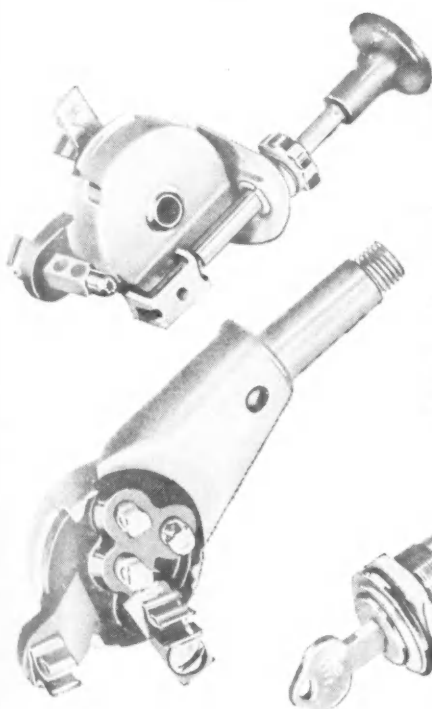


**SWAGING  
MACHINE**  
(for Production)



## THIS IS THE TERMINAL

that can't come off... It is SWAGED-ON with the machine or pliers. All switches shown on this page fit this Terminal. All are made and sold by H. A. DOUGLAS MFG. COMPANY.



**PLIERS**  
(for Service)

THE H. A. DOUGLAS COMPANY has never licensed anyone to manufacture or buy any Swaging machines or pliers made within the scope of our patents to be sold to, leased to, or in any way used by customers outside of their own factory.

## H. A. DOUGLAS MFG. CO.

202 RAILROAD STREET, BRONSON, MICHIGAN

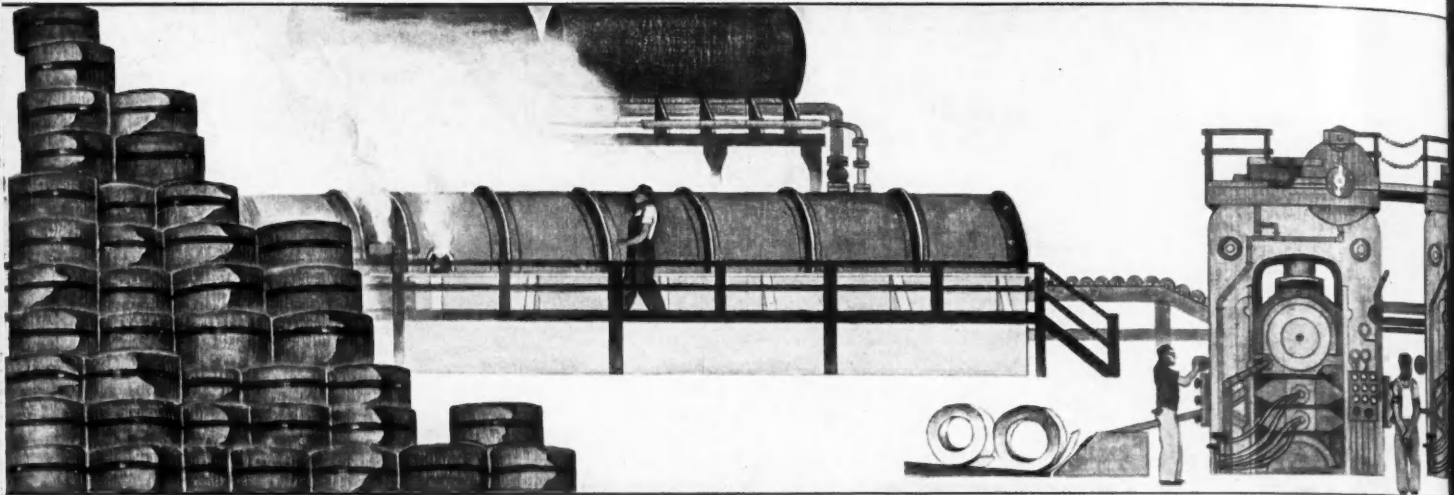
ORIGINATORS OF

*Swaged-On Snap Terminals* and DOUGLAS LIGHT CONTROL SYSTEM

# Investment for the Consumer

THE series of illustrations below depicts one unit of Bethlehem's long-range investment program to

meet the requirements of industry for quality steel products. This mill is one stage in the manufac-

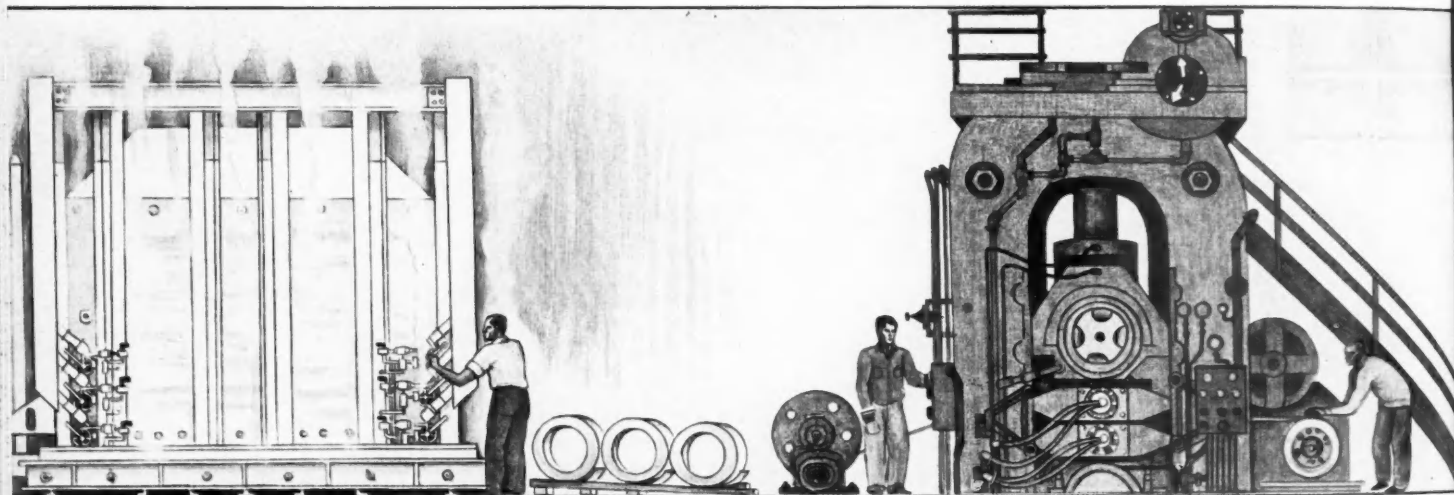


*Storage of hot-rolled strip*

Three-ton coils of hot-rolled strip go from storage to the continuous pickler, where they are uncoiled and passed through

*Continuous strip pickler*

325 feet of acid and water tanks, removing all scale and dirt. Dried, oiled, recoiled and weighed, they go on to...



*Annealing furnace*

Annealing furnaces, where coils are heated to a dull red and slowly cooled for 24 hours. Capacity—600 miles of strip.

*4-high skin-pass mill*

Then come polishing, tempering, and flattening by a light pass between the mirror-like rolls of the skin-pass mill...



*Pickler and water bath*

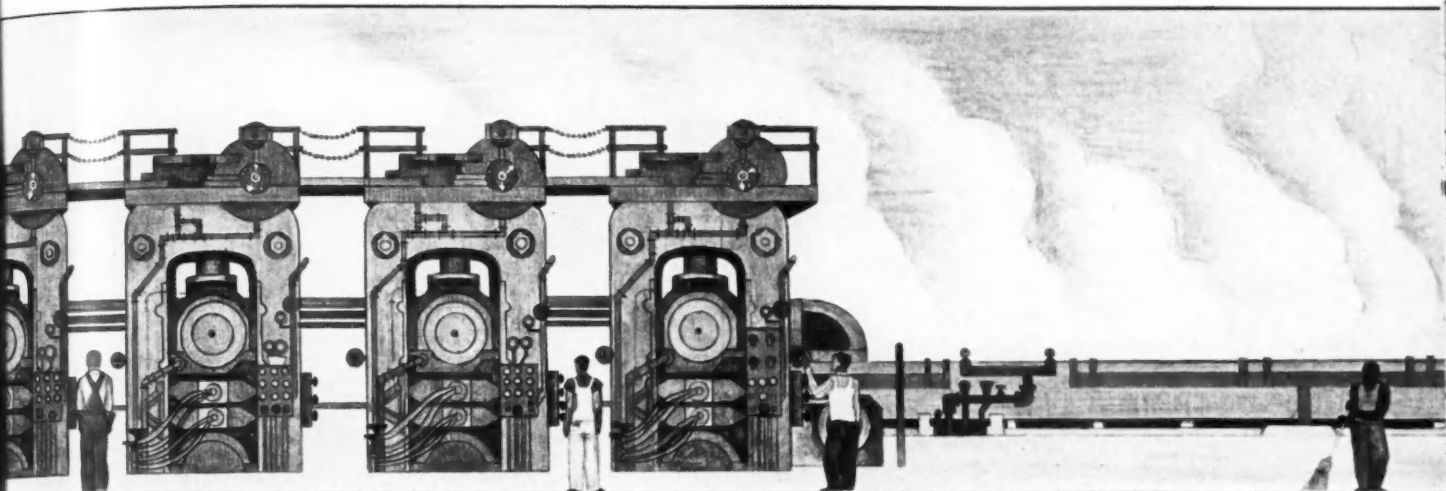
A final pickling, a water bath, and the sheets, still submerged in water, are conveyed to the tinning bath—all in a room where even the ceiling is insulated to keep any condensate

*Tinning bath*

from dripping. A final coating of palm oil, a cleaning off of excess oil by rolling through bran chaff, and sheets are ready for their final inspection and sorting.

ture of cold-reduced tin plate. Its high precision and the almost surgical cleanliness maintained in its operation are typical of the exceptional care exercised in the manufacture of all Bethlehem products to fit them for the intended service.

Controlled-cooled rails, electrically zinc-coated wire, improved alloy steels, more durable rock drilling steels are other examples of Bethlehem's manufacture of steel products in step with the widening demands of modern industry.

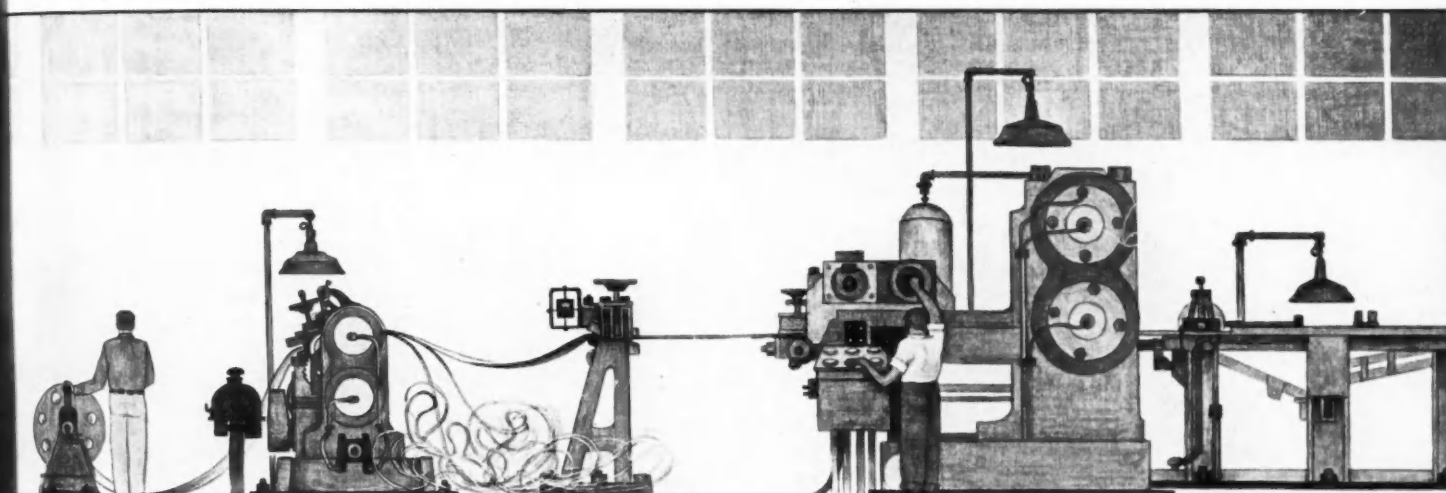


*4-high tandem rolling mill*

The tandem mill, where they are rolled through five stands down to a thickness of 5 or 10 thousandths of an inch.

*Electrolytic bath*

Then another washing and scrubbing, this time in an electrolytic alkaline bath. Dried, recoiled, they are delivered to...



*Slitter*

In another spotless, bright room, coils are once more uncoiled, trimmed to exact width, leveled, and sheared into

*Leveler and flying shears*

sheets. A testing laboratory checks their physical properties... an automatic weighing machine classifies them as to gage.



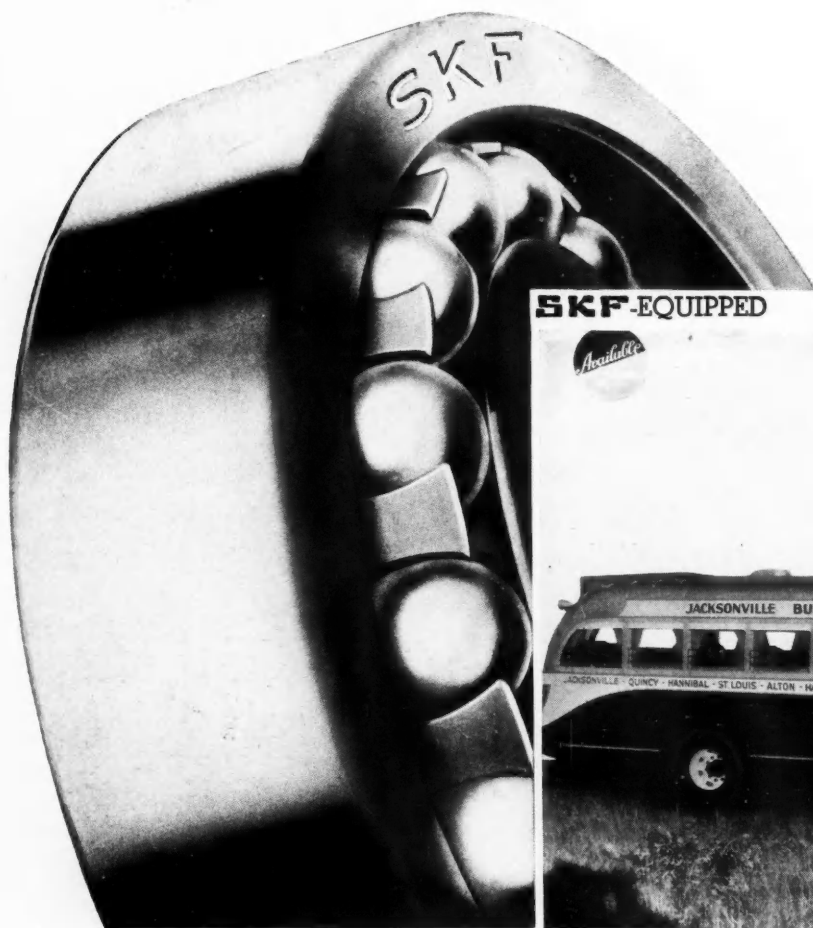
*Bran-chaff rolls*

*Sorting, inspecting and packing*

**BETHLEHEM STEEL COMPANY**







SKF-EQUIPPED

BUILT BY AVAILABLE TRUCK CO.



# SKF-EQUIPPED BUSES

*run smoothly... efficiently... economically*

It is significant that the same make of bearing that made good in horse-and-buggy days is used on this modern 29-passenger Intercity bus.

The symbol **SKF** is assurance that the bearings on center support, pilot shaft and transmission locations are manufactured to the highest standard of accuracy and from the finest steels obtainable. It is a tacit promise of unparalleled performance, economy and efficiency of the bus to which **SKF** Bearings are assigned. The more you know about bearings, the more you'll appreciate the many advantages that go with **SKF**.

3759

**SKF** INDUSTRIES, INC., FRONT ST. & ERIE AVE., PHILA., PA.



MORE THAN  
**1200**  
TYPES AND SIZES

Industry comes to **SKF** for unbiased bearing counsel because **SKF** makes practically all types of anti-friction bearings.

February 6, 1937

# SKF

**BALL AND ROLLER BEARINGS**

*Automotive Industries*

(Continued from page 196)  
grinders to its line of production tools. The new units are designed for general-purpose grinding and, with the proper wheel equipment, may be used for wire brushing, buffing and polishing or metal surfaces.

One of these grinders has a capacity for a 5-in. wheel, the other a 6-in. wheel. On each tool the motor is completely encased in a copper shield which excludes dust and conducts motor heat to cooling air. A fan forces air over this shield, out over the gear case, and onto the work.

Net weight of the 5-in. wheel model is 13½ lb. The 6-in. wheel model weighs 22 lb. Standard models available operate on 110 V. or 220 V., and special units which will operate on 32 V. or 250 V. can also be supplied.

## High-Speed Shear

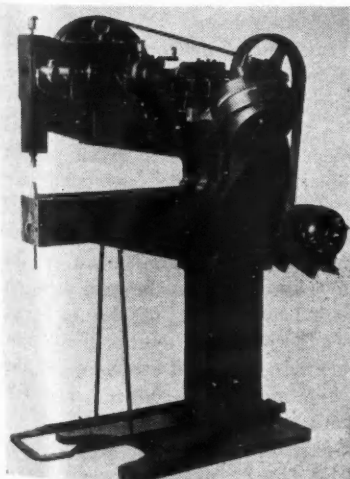
**Machine for Cutting 12 Gage Metal Has Throat Depth of 60 In.**

A high-speed shear for irregular shapes and constructed primarily to cut 12 gage stainless steel or similar alloys was recently manufactured by the Libert Machine Co., Green Bay, Wis. The machine was built with an all-steel frame, fabricated with ½-in. and ¾-in. plate and welded. It has a throat depth of 60-in., instead of the usual 36 in. and, according to the manufacturer, will maintain the same cutting speed as the standard gear.

## Underfeed Clinchor

**Tomkins-Johnson Develop Machine With 24-In. Throat Depth**

An underfeed Clinchor for handling large pieces has been developed by the Tomkins-Johnson Co., Jackson, Mich. The new machine has a throat depth of 24 in.



24-in. throat Clinchor

As in the 8-in. throat machine manufactured by this company, the clinch nuts are automatically fed to the ram. In operation, the work is located over the nut which is set by a single stroke of the ram. At the end of the up stroke of the ram, another clinch nut is supplied to the anvil. Each step in the supply cycle may also be accomplished manually.

## Phenolic Resins

**New Line for Industrial Bonding Applications by General Plastics**

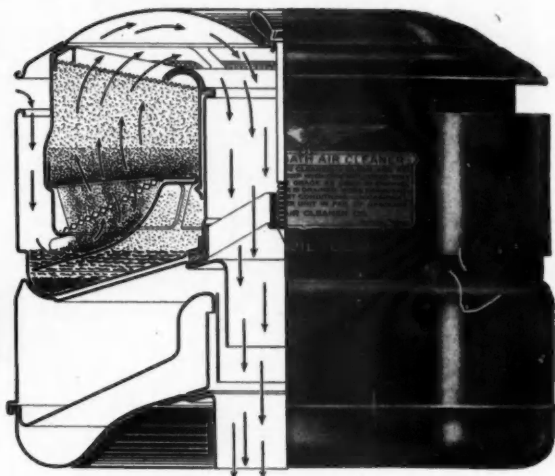
General Plastics, Inc., North Tona-

wanda, N. Y., has announced a new line of thermosetting phenolic resins in both liquid and powdered forms designed for numerous industrial bonding applications. Certain types, when used with rubber and drying oils or by themselves in impregnating or bonding loose or woven asbestos, give the finished product a higher heat resistance, more strength and a uniformly stable coefficient of friction. Other resins in this series are used to improve the properties of fixed resistance units or the bonding of ground cork in the production of stronger, more flexible and more heat-resisting gasket stock.

## HIGHEST AIR CLEANING EFFICIENCY



**OVER  
31%**



**of all cars and trucks sold in so-called dust areas today have United Oil Bath Air Cleaners • • • •**

During the past year when nearly one-third of cars and trucks that rolled off production lines for use in so-called dust areas were protected for more than life by United Oil Bath Air Cleaners, you may be sure that you're reading about a cleaner that "has something."

What this cleaner has is, first, extremely high cleaning efficiency, then simplicity in design and, next, solidity of construction that keeps it working long after it would have racked to pieces had it been built by customary methods.

Its extremely high cleaning efficiency is the result of certain patented features incorporated in a United Oil Bath Air Cleaner—features not found in other cleaners. Because of these features, the air stream produces greater oil turbulence which gives better and faster oil washing action, thus higher cleaning efficiency.

Its superiority is already accepted by more than a million users. Its proven merits make UNITED preferred by many leading car, truck and farm tractor manufacturers. If you have a problem of carburetor air cleaning, tell us about it.

**UNITED AIR CLEANER CO.**

9705 COTTAGE GROVE AVE., CHICAGO, ILL.

## Properties of Lubricating Oils

**R** ESEARCH project No. 6 of the American Petroleum Institute relates to the chemical constituents of lubricating oil. In a paper presented at the meeting of the Institute by Frederick D. Rossini, information was given concerning the constituents of a de-waxed, solvent-extracted Mid-Continent petroleum. It was found that the oil consists substantially of naph-

thene (cycloparaffin hydrocarbons with from one to four rings per molecule, with paraffin side chains. The oil contains no paraffin hydrocarbons. The effect of structure on the physical and chemical properties of pure hydrocarbons are also discussed by the author, who states that the manner in which certain physical or chemical properties change with chemical structure can be

satisfactorily ascertained only by means of experiments in which substantially pure hydrocarbons of known structure are subjected to appropriate tests.

"The accumulation of this desirable information has been greatly handicapped because of the relatively small number and amount of hydrocarbons of high molecular weight which have been synthesized. However, within the past five years, the syntheses of some hydrocarbons of high molecular weight, with values of their properties, were reported by a number of investigators; and a notable contribution to this field was made recently by Mikeska, of the Standard Oil Development Company, who synthesized and determined the properties of 52 different hydrocarbons, of high molecular weight, of types which might be expected to be present in lubricating oil. This work of Mikeska's appears to be by far the most extensive and conclusive which has yet been reported, and includes hydrocarbons of 16 to 60 carbon atoms per molecule containing nuclei of benzene, naphthalene, diphenyl, and their hydrogenated products.

"In general, it may be said that, for a given number of carbon atoms in the molecule, the viscosity increases with increase in the complexity of the molecule—whether it be more branching in the side chain, the substitution of shorter side chains for a longer one, or greater cyclization of the nucleus. Unsaturation, through the introduction of a double bond in the side chain, produces a slight decrease in the viscosity; and hydrogenation of unsaturated cyclic nuclei produces a moderate increase in the viscosity.

"The most generally used measure of the change of viscosity with temperature for an oil is the viscosity index, in which increasing values of the index correspond to decreasing values of the temperature coefficient of viscosity. In general, the viscosity index increases with the length of the side chain in a molecule; and, for a given number of carbon atoms, decreases with increase in the complexity of the molecule—whether it be more branching of the side chain, the substitution of shorter side chains for a longer one, or increased cyclization of the nucleus. The introduction of a double bond into the side chain attached to the cyclic nucleus of the molecule produces a slight increase in the viscosity index. With the hydrogenation of unsaturated cyclic nuclei, the viscosity index remains substantially unchanged.

# THOSE HIDDEN COSTS...NOW ARE PROFITS!




The correct  
oil film  
to each  
individual  
bearing...  
*automatically*

# BIJUR

AUTOMATICALLY *Correct* LUBRICATION

BLISS  
Power  
Press

- Remember them? Oiling time lost from productive work . . . Lubricant wasted . . . Production delays . . . Increased depreciation.
- How those hidden costs gnawed at profits! Money that now is clear . . . simply by the convenient, economical use of **BIJUR** lubricated machines. Clean lubricant is pumped and fed automatically . . . to each bearing the correct oil film it individually requires. No lubrication troubles . . . even to think about!

BIJUR LUBRICATING CORPORATION
LONG ISLAND CITY, NEW YORK

707



"The boiling point of hydrocarbons is primarily dependent on the molecular weight—although, for molecules containing a given number of carbon atoms, there is a significant change with the structure of the molecule. In general, it may be said that the boiling point decreases slightly with the introduction of a double bond in the side chain, and decreases moderately on hydrogenation of unsaturated cyclic nuclei. For a given number of carbon atoms in the molecule, branching in the side chain tends to produce a lowering of the boiling point.

"The property of 'oiliness' of an oil is one concerning which there is much to be learned; and a large number of investigators have been, and are, carrying out studies in this field. It will probably be found that the phenomenon of 'oiliness' is the resultant of a number of more fundamental physical properties, each of which will be susceptible of scientific evaluation by more or less simple methods of measurement. The breaking down of the property of 'oiliness' into its simple components is resulting in a great deal more useful information than the empirical study of the phenomenon as a whole. It will be of interest to learn definitely whether the actual hydrocarbons present in the oil differ from one another in oiliness.

"The subject of the resistance of hydrocarbons to chemical reaction by oxidation or decomposition at the temperatures and pressures encountered in an operating engine is a very broad one. While there exists a large amount of data on petroleum oils of various sources and degrees of fractionation, practically no work has been done to determine the susceptibility to oxidation and thermal decomposition of the various types of pure hydrocarbons of high molecular weight. A knowledge of the definite 'service' value of the various types of hydrocarbons with respect to stability or resistance to chemical reaction under conditions approximating those of actual service is greatly needed.

"The necessity for making such observations under the appropriate 'service' conditions is evident when it is realized that the rates of these reactions are markedly affected by the temperature, and may be greatly influenced by the nature of the metals in contact with the oil."

## Economy in Fleet Operation

(Continued from page 171)

manifolds, increasing the temperature of the fuel mixture and the thermostat in the water outlet of the cylinder block opens at 162 deg.

For controlling the engine to any desired speed between 1400 and 3000 r.p.m., a velocity-type governor can be installed between the carburetor and the inlet manifold. The vehicle speeds corresponding to these engine r.p.m. vary with the gear ratio and tire size. The passenger car with a 3.73 to 1 axle ratio can be governed at any speed within the range of 30 to 65 m.p.h., while the 1½ ton truck with a 6.16 to 1 axle ratio can be governed at any speed between 21 and 45 m.p.h.

The special Chevrolet engine is available in the following models: pas-

senger car, sedan delivery, ½ ton truck and 1½ ton truck. The Master model with this engine installed has a 3.73 to 1 axle ratio, while the Master deluxe has a 4.22 to 1 axle ratio. On the ½ ton truck, axle ratios of 4.11 to 1 and 3.82 to 1 are optional; and the 1½ ton model, ratios of 5.43 to 1 and 6.16 to 1.

Plymouth offers two standard "economy groups" for 1937 models. Available in Group No. 1 are a special intake manifold, a downdraft carburetor with a 1-in. nominal size instead of 1¼ in., and an axle ratio of 3.7 to 1.

With the optional carburetor, the



## METAL SPHERES WITH LAPPED SURFACES

Strom Steel Balls possess that extra measure of quality by means of which the ultimate in ball bearing performance is achieved.

This special lapping practice is exclusive with Strom.

Physical soundness — correct hardness — size accuracy and sphericity are guaranteed in all Strom Balls.

Other types of balls — STAINLESS STEEL — MONEL — BRASS & BRONZE — are also available in all standard sizes. Write for full details.

# Strom

## STEEL BALL CO.

1850 So. 54th Avenue, Cicero, Ill.

The largest independent and exclusive Metal Ball Manufacturer

maximum horsepower developed is 65 at 3500 r.p.m. In comparison with a Plymouth having standard equipment, the acceleration of a car with these changes is reduced 12 to 15 per cent at speeds below 40 m.p.h., and the maximum speed is limited to about 65 m.p.h.

Group No. 2 includes all of the items in Group No. 1 and, in addition, a hardened-steel throttle stop and manifold heat shields. The hardened-steel throttle stop is adjustable and serves to limit maximum car speed. The manifold heat shields are provided to increase the manifold temperatures.

### International Automobile Standards

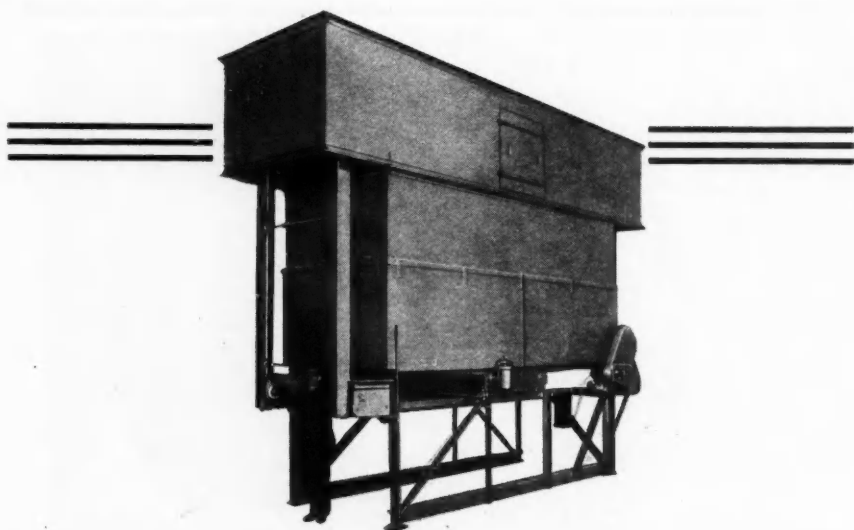
Fifteen standards or recommended practices relating to automotive subjects have been formulated by Technical Committee 22 of the International Standards Association, and have been agreed to by the national standardizing bodies of 16 countries. These standards, which are published in ISA Bulletin No. 10, are as follows: Speedometer and tachometer drive with finger, size of holes for instruments (tachometers, pressure gages, clocks, etc.), oval flanges for carburetors,

travel of carburetor-throttle and governor levers, 14-mm. and 18-mm. spark plugs, mountings of bumpers for private cars, threaded radiator and tank caps, position of pedals, mounting of distributors, mounting of headlamps, terminals for batteries, motion of gear-ship levers, direction of rotation of instruments and machines, diameter of steering wheels, and threaded knobs for gearshift levers.

### Calculation of Geared Drives

Die Getrieberechnung unter besonderer Berücksichtigung der Drehzahlnormung (Calculation of Geared Drives under special Consideration of the Standardization of Speeds of Rotation) by A. Wallichs and H. Schopke. Published by VDI Verlag, Berlin NW 7, Germany.

IN Germany the spindle speeds of machine tools have been standardized. The normal or standard speeds of the work spindles are made so as to represent successive powers of 1.06, which when raised to its fortieth power gives 10. It is claimed that the use of these standard ratios offers important advantages from the standpoints of simplicity of arrangement of geared drives and of the work involved in their design. The pamphlet under review deals with the determination of tooth numbers and pitches for such geared drives by means of printed forms. It should be of interest to designers of machine tools and electrical designers working on variable geared drives for electric motors.



## AUTOMATIC PRODUCTION CLEANING WITH BLAKESLEE DEGREASERS

Heavy production and thorough cleaning are maintained with BLAKESLEE DEGREASERS and BLACOSOLV, the super degreasing solvent.

Solvent degreasing renders your metal parts clean—dry in less than a minute. It is the most thorough metal cleaning process known.

No scrubbing—no soaking—no rejects. Cut your labor and cleaning costs with Blackeslee Production Degreasers—all phases of degreasing—all types of machines from hand operated to completely automatic.

Let our trained engineers tell you how and where we help the automotive industries.

*Literature or Free Demonstration Furnished  
Upon Request.*

## G. S. BLAKESLEE & CO.

EASTERN SALES OFFICE  
381 4th AVENUE  
NEW YORK, N. Y.

MAIN OFFICE & WORKS  
CICERO STATION  
CHICAGO, ILL.

### The Airplane and Its Engine

The Airplane and Its Engine, by C. H. Chatfield, S.M., director of research, United Aircraft Mfg. Corp., C. Fayette Taylor, M.E., professor of automotive engineering, Massachusetts Institute of Technology, and Shatswell Ober, S.B., associate professor of aeronautical engineering, Massachusetts Institute of Technology. Third edition. Published by McGraw-Hill Book Co., Inc., New York. 401 pages. \$5.00.

THIS new edition has been thoroughly revised to take account of the progress in aeronautics during the four years since the second edition was published. In addition to including descriptions and illustrations of recently developed airplanes and engines, which have replaced earlier types, the authors have made numerous changes in the text and have simplified their explanations of fundamental principles. Particular care has been exercised to exclude from the text any technical material which would require more than a knowledge of elementary physics and mathematics for complete understanding. The book merits the attention of those who are interested in gaining knowledge of basic principles and a broad picture of developments in aircraft. Students will find this text useful as a reliable source of general information on the subject.